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Forecasting the Applicability of Aviation Integrated Logistics Support Concepts to the Fleet

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The Coast Guard's aviation and nonaviation logistics communities are addressing a major management challenge through two system automation projects: the Aviation Maintenance Management Information System (AMMIS) for aviation logistics support and the Systems to Automate and Integrate Logistics (SAIL) for Fleet logistics support. The Coast Guard tasked us to analyze AMMIS to determine whether it or parts of it could equally well provide the nonaviation (Fleet) community with logistics support. We believe that some key aspects of aviation logistics support concepts and their implementation in management structure and business practices are applicable to Fleet logistics support. Our major recommendations are: streamline a technical channel, manage maintenance centrally, relate mission performance to equipment, centralize maintenance reporting and recording, tailor inventory management strategies to critical needs, centrally fund and budget for sustaining support, establish a prime unit for a technical responsiveness link to the field, and streamline configuration change procedures. We also examined the overall environment in which AMMIS is being developed. The following conclusions drawn from analysis of the AMMIS development are directly relevant to the development of SAIL. For each conclusion, we provide a major recommendation. System design is limited by the environment in which it must operate; organizational differences can affect how software applications are utilized; functional managers need to be trained in advanced techniques in order to use the SAIL system effectively; configuration control boards are needed early to monitor functional development.

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Executive Summary

FORECASTING THE APPLICABILITY OF AVIATION INTEGRATED LOGISTICS SUPPORT CONCEPTS TO THE FLEET

The Coast Guard's aviation and nonaviation logistics communities are addressing a major management challenge through two system automation projects: the Aviation Maintenance Management Information System (AMMIS) for aviation logistics support and the Systems to Automate and Integrate Logistics (SAIL) for Fleet logistics support. Development of AMMIS began in 1985 and SAIL in November 1989; during the ensuing years, both systems have evolved and today, each project seeks to provide the Coast Guard with modern automated information management systems for supply, maintenance, finance, and configuration management.

Because the two logistics communities – aviation and Fleet – face similar challenges and aviation has a 4-year head start in development of an automated system, the Coast Guard tasked us to analyze AMMIS to determine whether it or parts of it could equally well provide the nonaviation (Fleet) community with logistics support.

We found that aviation logistics concepts emphasize intensive management of safety-of-flight and other critical aircraft equipment and systems. Additionally, the aviation logistics management structure and business practices – particularly those needed for supply, maintenance, and financial management – are designed and implemented to support that management intensity. The functional system requirements governing AMMIS reflect those concepts, structure, and practices.

Our previous studies show that compared to aviation logistics, Fleet logistics lacks a specific focus, i.e., primary logistics planning objective equivalent to safety-of-flight or critical-equipment-intensive management, for its logistics support concept.[1] We found that both the planning for Fleet logistics support and the

[1]LMI Report CG701R1, *Improving Shipboard Supply Management in the Coast Guard*, George L. Slyman, et al. October 1987; LMI Report CG701R1 Supplement, *Focusing Planning for Supply Management: Objectives, Policies, Oversight and Review*, George L. Slyman, et al. April 1988.

provision of resources for that support were based upon estimates of the minimum support needed to "get underway" and applying potentially more costly solutions to emergency requirements.

We believe that some key aspects of aviation logistics support concepts and their implementation in management structure and business practices are applicable to Fleet logistics support. Presented below are our major recommendations for actions on key aspects of the support concept we believe should be implemented in the Fleet logistics management structure and business practices.

- *Streamline a Technical Channel:* Continue the planning for the establishment of a Fleet Logistics Center (FLC) consolidating the supply centers and the headquarters' supply planning, maintenance planning, and maintenance engineering functions. When the FLC is established, consolidate each Maintenance and Logistics Command's (MLC's) electronics resources and naval engineering resources in the Vessel Support Division and at the shoreside support units.

- *Manage Maintenance Centrally:* Assign to a single headquarters office the responsibility for establishing all maintenance policy affecting propulsion equipment, auxiliary equipment, and naval engineering-related electronics equipment and systems; assign to a single individual at the unit level the responsibility for all maintenance for those equipments and systems, and give that individual direct control over the personnel needed to maintain the equipment and systems.

- *Relate Mission Performance to Equipment:* Establish and implement uniform measures to relate equipment on each cutter class to operating performance and operating performance to mission capability.

- *Centralize Maintenance Reporting and Recording:* Establish policies for each vessel to report required and completed maintenance actions to a central maintenance data collection point. That information can be used in managing maintenance and supply requirements and assigning underway missions to cutters.

- *Tailor Inventory Management Strategies to Critical Needs:* Implement a materiel-type coding structure as the foundation for inventory-intensive management techniques.

- *Budget for Sustaining Support:* Begin centrally funding all mandatory allowances and provide Fleet supply and equipment budget requests to the Commandant (G-ELM) for staff level review.

- *Establish a Prime Unit for a Technical Responsiveness Link to the Field:* For each cutter class, establish a single point to provide technical assistance for

field-level maintenance and determine whether extending a similar concept to small boats would be effective. Headquarters should develop a draft implementation plan for review by the MLCs and districts.

- *Streamline Configuration Change Procedures:* Streamline the Fleet configuration change approval and implementation process to be consistent with the recommended central maintenance policy and technical assistance structure.

In the process of analyzing the aviation logistics support concepts for applicability to Fleet support, we examined the overall environment in which AMMIS is being developed. Our objective was to determine how the system environment, organizational structure, and organization roles and responsibilities affected AMMIS development and whether the SAIL effort could benefit from any lessons learned in the AMMIS program. We believe the following conclusions drawn from analysis of the AMMIS development are directly relevant to the development of SAIL. For each conclusion, we provide a major recommendation.

- *System design is limited by the environment in which it must operate:* The Coast Guard should design SAIL to use decentralized processing with distributed capabilities. It should change Commandant Instruction (COMDTINST) 5230.40 to provide a unit-support-level capability for developing special reports and management innovations and resolving standard workstation technical and configuration problems.[2]

- *Organizational differences can affect how software applications are utilized:* The Coast Guard should establish a program to standardize the central shipboard supply organization at all units and require that organization to implement its procedures prior to installing SAIL applications. It should establish policies that make it easier for the users to develop local applications and submit those applications to a review board for Coast Guard-wide use.

- *Functional managers need to be trained in advanced techniques in order to use the SAIL system effectively.* The Fleet logistics organization should utilize AMMIS training experience and on-site training capability to assist them in developing the necessary expertise to take full advantage of SAIL capabilities.

- *Configuration Control Boards are needed early to monitor functional development:* The Coast Guard should establish Fleet Configuration Control

[2]COMDTINST 5230.40, *Coast Guard Standard Workstation System Management and Support*, 31 May 1990.

Boards to review and integrate functional system requirements and approve software applications prior to delivery to units.

We previously recommended the Coast Guard adopt response-oriented planning as a logistics objective and develop policies that ensure a focus on establishing a response-oriented logistics system.[3] We believe that aviation support concepts and business practices can be used as models in developing a response-oriented system for Fleet support and that establishing response-oriented capabilities in SAIL will improve Fleet support. Additionally, similar management structure and business practices make AMMIS software applications more acceptable. Using selected applications for SAIL should shorten development time and reduce life-cycle system development and maintenance costs.

[3]LMI Report CG701R1 Supplement, op. cit.

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CHAPTER 1

OVERVIEW

INTRODUCTION

The U.S. Coast Guard is committed to developing modern automated information management systems to further integrate its supply, maintenance, financial, and configuration management functions. The Systems to Automate and Integrate Logistics (SAIL) project is tasked with achieving modern automated systems for the Coast Guard nonaviation community.[1] By consolidating all Fleet logistics information systems activities, the SAIL project will create one uniform process for each user level. Its philosophical foundation is that wherever possible it will use available software rather than developing the software to suit the application.

The Coast Guard aviation community is developing the Aviation Maintenance Management Information System (AMMIS) to modernize its automated information systems. The AMMIS project, initiated in 1985, is expected to complete development of aviation automated systems during FY92. When complete, AMMIS will

> . . . support the management of repair, overhaul, supply, accounting, and flight operations for users at the Aircraft Repair and Supply Center (AR&SC), all Coast Guard air stations, and Coast Guard Headquarters [Chief, Aeronautical Engineering Division (G-EAE) and Chief, Aeronautical Operations Division (G-OAV)].[2]

Additionally, the Aviation Computerized Maintenance System (ACMS) and Standardized Air Station Inventory (SASI) system are closely related to AMMIS development.[3]

Both AMMIS and SAIL have evolved to become comprehensive programs under which all logistics support systems are being developed for the aviation and

[1]Throughout this report, we use the terms "nonaviation community" and "Fleet" interchangeably to refer to the multilayered logistics organizational structure providing sustaining support to Coast Guard vessels.

[2]U.S. Coast Guard, *Functional Requirements Document for the Aviation Maintenance Management Information System (AMMIS)*, 25 November 1987.

[3]This study considers ACMS and SASI to be subsumed under the AMMIS umbrella. Any reference to evaluating AMMIS includes its relationship to ACMS and SASI.

nonaviation communities. The Coast Guard explicitly recognizes Systems to Automate and Integrate Logistics (SAIL) as the umbrella under which all Fleet logistics information resource management activities are being developed. Similarly, AMMIS, although not explicitly recognized as such, has evolved and become aviation's umbrella for automating logistics support.

Given SAIL's purpose and AMMIS's scope, it is appropriate to examine whether either part or all of AMMIS could serve the Fleet community. Such an examination is especially appropriate when one considers the inherent efficiency of utilizing already developed and tested software applications and realizes that the Coast Guard, in general, is more willing to accept a system developed specifically for its use. However, drawing meaningful conclusions about AMMIS's applicability to the Fleet requires an understanding of the policies and procedures that govern the aviation community and the roles, responsibilities, and relationships among aviation organizations in the Coast Guard.

STUDY OBJECTIVES

Our study has two objectives:

- To determine whether the aviation and Fleet communities can apply similar concepts or have areas of similarity in their basic concepts for integrated logistics management.
- To analyze the functional processes and business structure underlying AMMIS, recommend the applicability of part or all of AMMIS to the Coast Guard's nonaviation community, and identify policy and organization changes needed for implementing AMMIS to support the nonaviation community.

MAJOR ISSUES

In this study, we analyze three major issues:

- Can the Coast Guard apply the aviation logistics support organizational roles and responsibilities, relationships between activities, and information flows to Fleet logistics support?
- From a functional standpoint, should AMMIS be implemented by the nonaviation community in light of its policies and organizational structure for providing supply, maintenance, financial, and configuration management and its potential for bringing about changes in policy, organization, roles, responsibilities, and relationships?

- If AMMIS should not be implemented in total, should any of the AMMIS software modules be implemented by the nonaviation community?

AREAS OF ANALYSIS

In Chapter 2, we examine eight areas in which integrated logistics support concepts are used by the aviation community. We discuss the applicability of those concepts to Fleet integrated logistics support. In Chapter 3, we discuss four SAIL-related lessons learned from our analyses of AMMIS development. In both chapters, we present our findings, conclusions, and recommendations in each area.

We do not address the applicability of AMMIS software modules either in total or in part, to the nonaviation community. System specifications, the level of detail below the initial functional requirements, are being reviewed by AR&SC. Unit specifications, providing the maximum detail, are expected to be available 6 months after system specifications are approved. We believe that unit specifications must be reviewed before making any recommendations concerning AMMIS's applicability to the nonaviation community. Thus, in a future report, we will deal with whether the AMMIS software modules are functionally applicable to the nonaviation community.

CHAPTER 2

AVIATION SUPPORT CONCEPTS

CRITICALITY OF LOGISTICS SUPPORT TO AVIATION COMMUNITY

Both the aviation and nonaviation communities believe that the Coast Guard places greater importance on aircraft support than on surface ship support. This difference in emphasis is explained by Coast Guard personnel in the often-stated position that "aircraft fall out of the sky, ships don't fall out of the sea."

The aviation community translates that emphasis into policy by designating selected aviation equipment and systems as critical to "safety of flight" and specifying that no aircraft will be flown unless all safety-of-flight equipment is operational. Consequently, the Coast Guard stresses the management of those equipments or systems whose failure would adversely affect flight safety. Aviation program managers can get high priorities for their goals when they can successfully relate proposed requests for logistics support to safety-of-flight issues. However, that emphasis is not enough by itself to obtain full program funding. Sound business practices are needed to augment the safety-of-flight issues, and those sound business practices adopted by the aviation community generate the funding to implement advanced supply and maintenance management capabilities. Figure 2-1 depicts the perceptions existing in the aviation and Fleet support communities.

In the remainder of this chapter, we describe various integrated logistics support concepts used by the aviation community to provide aviation support. We forecast the applicability of those concepts to the Fleet's integrated logistics management requirement and make recommendations for the adoption of those concepts by the nonaviation community.

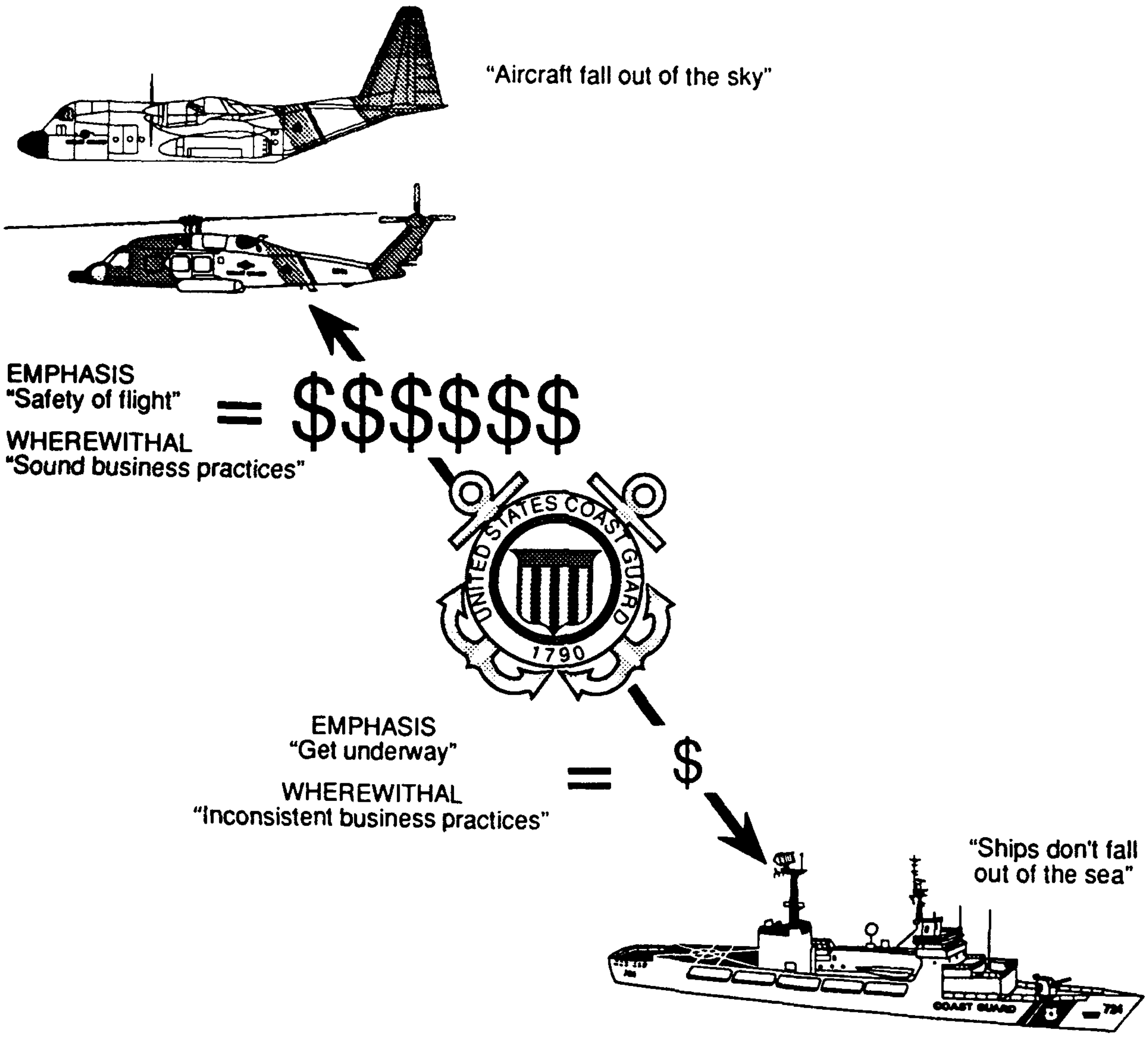


FIG. 2-1. COMMON PERCEPTIONS OF WHY DIFFERENCES EXIST IN RESOURCE ALLOCATION

STREAMLINED TECHNICAL CHANNEL

Findings

In the aviation support structure, a quick-reaction technical support channel integrates the supply, maintenance, financial, and configuration management functions for all categories of aviation materiel, including avionics. That quick reaction support streamlines aviation's technical channel for information, decision

making, and advice. It enables G-EAE to establish policy and plan for all supply, maintenance, financial, and configuration issues.

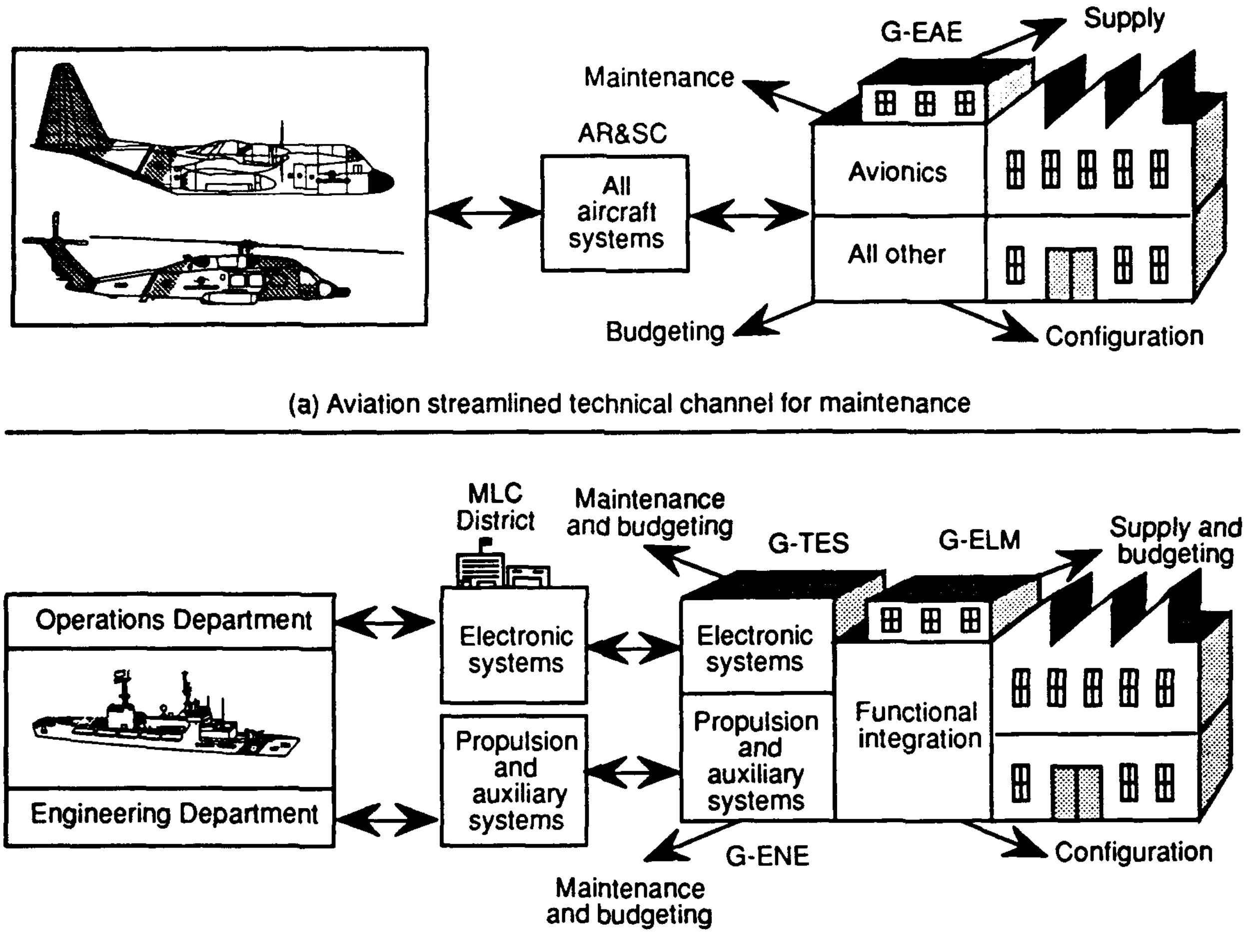
Additionally, aviation's integrated technical support channel provides each air station with a single point of contact/clearinghouse for both supply and maintenance functions. While air station operations are under the control of the district, air station supply and maintenance operate independent of district or Maintenance and Logistics Command (MLC) coordination or oversight.

Figure 2-2 compares the aviation streamlined technical channel for maintenance support and the Fleet support multilayered technical channel for maintenance. The aviation channel [Figure 2-2(a)] streamlines both decision making and dissemination of information as follows:

- All air stations can interact directly with G-EAE to resolve significant maintenance questions. The ability of an air station to discuss maintenance concerns directly with headquarters facilitates rapid response and early resolution of problems. Additionally, because G-EAE has visibility of major maintenance problems at the air stations, it knows how widespread particular problems are, can decide how to best resolve them, and knows what can be done to preclude their recurrence.
- The ACMS centralizes the recording and reporting of maintenance data for each air station.[1] Each air station obtains maintenance-due information and reports maintenance-performance data to a single contact point, the ACMS Computer Center in Beltsville, Md.
- The AR&SC plans and performs depot maintenance for all Coast Guard aircraft. Each air station can coordinate directly with AR&SC to determine when its aircraft are scheduled for overhaul.

The supply technical channel is streamlined through the relationship each air station has with AR&SC. AR&SC maintains visibility of all mandatory allowance reparables and repair parts stocked at Coast Guard air stations. If an item is not available at the air station, the air station orders it from AR&SC regardless of whether the item is managed by the Coast Guard or other Government agency (OGA). If it does not have the item, AR&SC initiates action to procure it

[1]The ACMS identifies individual maintenance tasks by a discrete code number and tracks compliance by the time the task was last performed and its planned maintenance interval. With the ACMS, maintenance tasks can be performed individually or in groups at the maintenance manager's discretion. Other features include scheduling critical component overhauls, life-limit tracking, and automated recordkeeping.



(a) Aviation streamlined technical channel for maintenance

(b) Fleet support multilayered technical channel for maintenance

Note: At Coast Guard Headquarters, three separate divisions are involved in the Fleet support technical channel: the Electronic Systems Division (G-TES), the Naval Engineering Division (G-ENE), and the Logistics Management Division (G-ELM)

FIG. 2-2. AVIATION VERSUS NONAVIATION TECHNICAL CHANNEL

commercially if it is Coast Guard-managed or through a requisition if it is OGA-managed. All materiel procured for the air station is shipped through AR&SC to the requesting station. Also, AR&SC centrally funds all allowances for air station-mandatory reparable items and repair parts, using the Allotment Fund Code (AFC) dollars provided by G-EAE.

Figure 2-2(b) depicts the Fleet support multilayered technical channel for maintenance management. The Maintenance and Logistics Commands (MLCs) and the districts are the Fleet's primary maintenance interfaces. They schedule and contract for cutter and boat maintenance and for any significant maintenance beyond

authorized dollar thresholds. (Budgeting and configuration issues also have a streamlined technical channel. Each of those areas is discussed later in this chapter.)

Conclusions

The structure depicted in Figure 2-2 is used by the Coast Guard today. Significant span-of-control issues will arise if all nonaviation units bypass MLC and district maintenance organizations and interact directly with headquarters. Because of the large number of cutters and small boats, the Fleet cannot readily duplicate aviation's streamlined technical channel for maintenance. While 28 air stations can interact directly with a single headquarters control point, it would be quite another thing for the entire Fleet to do so. Similarly, no clear benefit is apparent in combining headquarters and unit responsibilities for electronics systems and propulsion/auxiliary systems as long as they are organizationally separate at MLCs and the Coast Guard supply centers, the MLCs, and the shoreside support units.

The concept that all unit requests for materiel should flow through a central control point is feasible in the nonaviation community. In an earlier report, we proposed that a single Materiel Management Center (MMC) receive or have visibility over all Fleet materiel requests for Coast Guard- and OGA-managed items.[2] The MMC could assist in status inquiries and expedite requests. If the OGA materiel is not available, the MMC, with access to a technical engineering staff, can produce a solution more quickly than the unit can on its own. The basic data required to implement supply performance measures could be accumulated. (Additional advantages that would accrue are discussed later in this chapter.) Like AR&SC, the MMC would integrate many supply and maintenance functions. Under our proposed MMC, the inventory control point (ICP) functions and Headquarters supply planning, maintenance planning, and maintenance engineering activities would be combined into a single supply and maintenance management activity.

Central funding of reparable and repair part allowances using AFC dollars is also applicable to the Fleet. MLC funding of mandatory repair part allowances based on AFC dollars would help ensure all ships have 100 percent of mandatory allowance items either on hand or on order. If funding shortfalls preclude 100 percent support,

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[2]LMI Report CG701R1, *Improving Shipboard Supply Management in the Coast Guard*, George L. Slyman, et al., October 1987.

the MLC could rationalize funding priorities and prepare a strong defense for a budget request.

Recommendations

We recommend that the Fleet retain its multilayered technical channel for maintenance management as long as electronics and naval engineering are separate organizational entities at the MLCs and the shoreside support units. However, we believe organizational separation should end, and we further recommend that future organization changes at those levels include combining electronics and naval engineering maintenance management.

We also recommend that the Coast Guard continue to pursue the implementation of a single MMC, i.e., a single Fleet logistics management unit that consolidates supply center functions with headquarters supply planning, maintenance planning, and maintenance engineering functions.

CENTRALLY MANAGED MAINTENANCE

Findings

Central Control of Maintenance Performance

Coast Guard aviation is organized in such a way that all maintenance performance is controlled from a central organization. That feature is exhibited at headquarters and at each air station in the following ways:

- G-EAE is organized in such a way that platform managers and project managers centrally plan and direct all Coast Guard aeronautical engineering maintenance programs for the aircraft structural, mechanical, and engine components as well as for avionics, ground support equipment, and rescue and survival equipment. G-EAE also develops functional requirements and maintains oversight of the computerized aircraft maintenance system.
- Each air station engineering department is the single central control point for performing all aircraft maintenance, including that for avionics.

The air station aircraft maintenance program and all personnel resources required for aircraft maintenance are also centrally managed and controlled. The engineering officer is held accountable for the availability of all air station aircraft. Organizing aircraft maintenance under the authority of a single department head

allows that department head to set priorities for the most critical tasks. In fact, for this approach to be effective, the engineering officer needs to be responsible for all aircraft maintenance activities. No aircraft is grounded until all maintenance concerns have been considered. This organizational approach has gained widespread support as the integration of avionics throughout aircraft systems becomes widespread. Successful integration requires all types of aircraft maintenance to be funneled through a central control point.

Influence of Electronics Integration on Aviation Rate Responsibilities

The integration of avionics equipment maintenance with other aircraft maintenance has raised a question within the aviation community as to what equipment must be maintained by the aviation electronics technician (AT) and what equipment the aviation electrician mate (AE) can maintain. Traditionally, AEs maintained such aircraft systems as lighting, flight control, autopilot amplifiers, and compasses and ATs performed maintenance on general avionics equipment. This division of responsibilities worked well until the Coast Guard introduced the HU-25 Guardian aircraft. Traditional AE equipments such as the autopilot amplifier and compasses were operated by computer. A highly sophisticated electronics test rack (CTS-81) was needed to troubleshoot equipment for which the AE was responsible. Operation of that test rack proved beyond the technical skill of many AE-rated individuals, and the existing training program could not overcome that shortfall. Some air station engineering departments resorted to assigning their operations to anyone who could perform them. At some air stations, that resulted in the AT assuming responsibility for operating the CTS-81, and consequently, for maintaining equipment for which the AE was originally responsible. At those air stations, the role of the AE changed by default as ATs assumed that part of their work.

Conclusions and Recommendations

The aviation community concept that the headquarters platform managers and project managers and the air station engineering officer should control all of the resources responsible for maintaining assigned systems and also be responsible for all of the equipment installed in those systems has not been applied in the nonaviation community. Fleet maintenance support generally flows from Headquarters to the unit through two channels – one for electronics systems and the other for hull,

mechanical, and electrical (HM&E) systems. We see little benefit in combining unit responsibilities for electronics systems with HM&E systems as long as the unit's operations department is the single beneficiary of electronics maintenance support. However, a change may be warranted with the advent of electronics equipment integrated within HM&E systems.

Similar to the aviation experience, the number of Fleet electronics equipment being integrated in all types of systems is increasing as in the criticality of the systems. For example, the 270-foot medium-endurance cutter (WMEC) has a significant number of electronics controls and sensor systems installed in the propulsion plant. As performance measurement and diagnostic technologies advance, naval engineers will become responsible for more electronics equipment. Because of the increasing integration of electronics equipment, the nonaviation community should establish policy on how electronics equipment integrated within HM&E systems is to be consistently managed and maintained. The Fleet can build on the aviation community's experience by more clearly defining "electronics" and adopting key features of aviation's business structure.

Integrating electronic controls and sensor systems in HM&E systems highlights the need for the Coast Guard to use a more precise definition of electronics. We believe the electronic equipment integrated within G-ENE-managed HM&E systems should be referred to as "naval engineering electronics" and the electronic equipment managed by G-TES should be referred to as "command, control, and communications (C^3)."[3]

Applying key features of the aviation support management concept to nonaviation's management of HM&E systems would result in significant changes to both headquarters and the Fleet's business structure. We recommend that Coast Guard headquarters make the following management changes:

- G-ENE should manage naval engineering electronics equipment and provide any required technical assistance and subject matter expertise for design, procurement, installation, maintenance, and support issues.

[3]Throughout the remainder of this chapter we refer to G-TES-managed electronics systems as "C^3" electronics and G-ENE-managed electronics components integrated in HM&E systems as "naval engineering electronics."

- G-TES should continue as the program manager for all C^3 electronics equipment.
- G-ENE should exercise a scope of responsibilities for naval engineering electronics equipment similar to that currently performed by G-TES for C^3 equipment.
- The Coast Guard headquarters-level structure should recognize that the office responsible for a given system must also directly control the resources required to execute the program and that support for systems cuts across traditional commodity lines.
- The Logistics Management Division (G-ELM) should continue the program of implementing centralized shipboard supply, ensuring C^3 and HM&E spares are combined and managed by the Supply Officer.

Additionally, we recommend that the Coast Guard assign individuals with knowledge of naval engineering electronics to G-ENE. It should assign enough such individuals to carry out the responsibilities associated with managing the maintenance of naval engineering electronics equipment. We also recommend that headquarters-level responsibilities for managing electronics technicians (ETs) remain unchanged.

Unit-level maintenance responsibilities for C^3 electronic systems should continue to remain separate from HM&E systems. The engineering officer should have complete responsibility for all maintenance performed on propulsion and auxiliary equipment, including naval engineering electronics equipment. The operations officer should be responsible for maintenance performed on C^3 electronic systems.

With advance planning and personnel policy implementation, the Fleet can implement unit-level responsibilities and avoid personnel problems similar to those the aviation community encountered. We recommend that the Coast Guard evaluate the following alternative personnel policies to determine how best to implement the described changes in unit-level responsibilities:

- The first alternative involves changing the ET's responsibilities, relationships, and roles as shown in Figure 2-3. Those changes include the following:
  - Modify existing shipboard relationships so that all ETs are no longer assigned to the Operations Department; ETs should be assigned to the

Engineering Department to maintain all shipboard naval engineering electronics equipment.

- Distribute ETs within a unit on the basis of the relative amount of maintenance to be performed for C^3 systems versus HM&E systems.

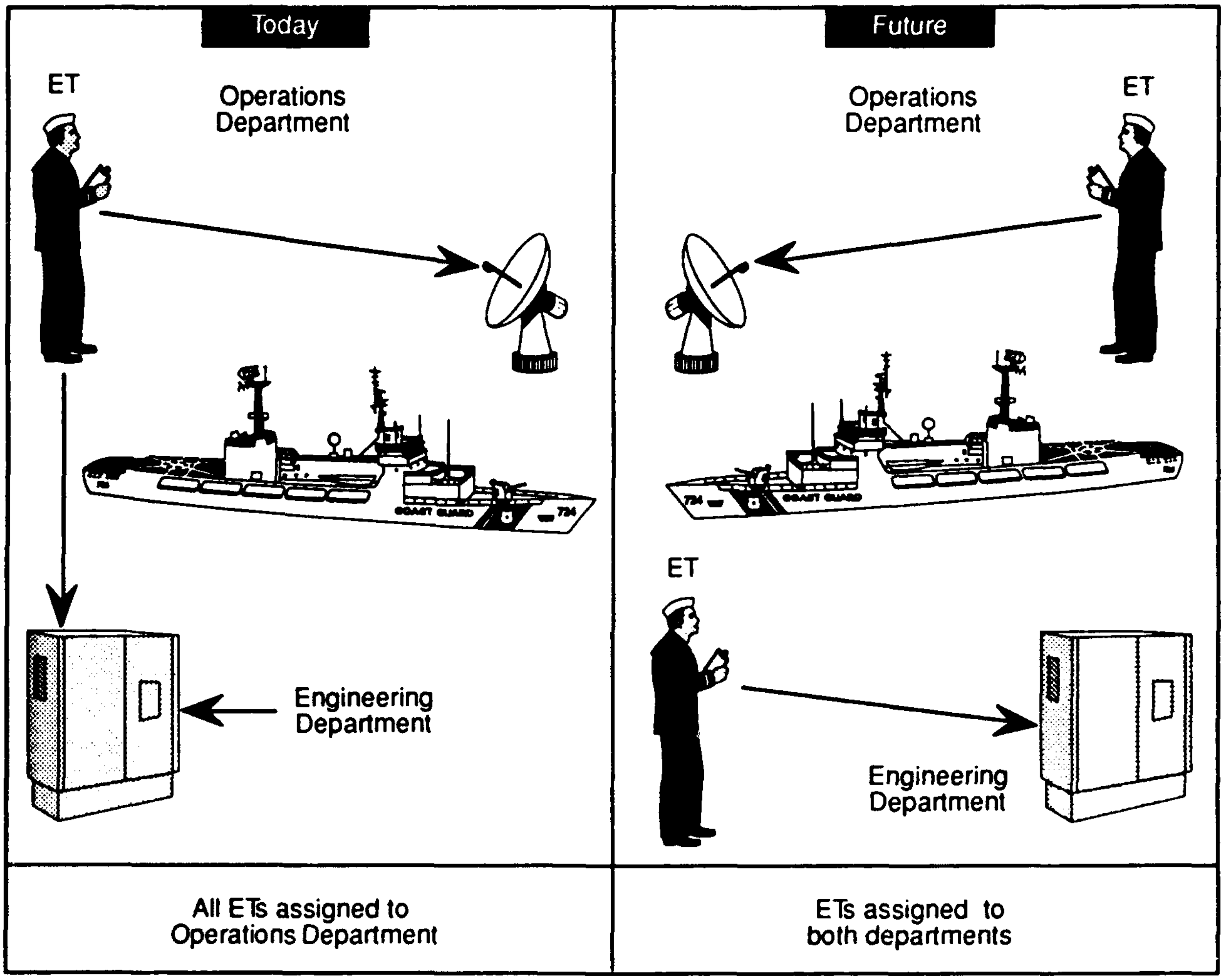

FIG. 2-3. ALTERNATIVE FOR MODIFYING FLEET UNIT-LEVEL RESPONSIBILITIES, RELATIONSHIPS, AND ROLES

- The second alternative is to assign maintenance of naval engineering electronics equipment to the machinery technician (MK) rating. The trends in electronics should facilitate this type of reassignment of responsibilities. Since less and less electronic equipment is repaired down to the component level, knowledge of individual components is becoming less important. Additionally, acquisition logistics-related policies can identify which components should be repaired above the organizational maintenance level.

Thus, the computer that controls the propeller speed would be treated as an assembly. If it failed, it would be replaced and the failed computer turned in to a higher maintenance level for repair.

Factors to consider in evaluating the alternatives include: (1) the additional investment in reparables to support a general policy of repairing naval engineering electronics equipment above the organizational maintenance level, (2) the MK versus ET training costs to assume naval engineering electronics maintenance responsibilities, (3) the management "cost" of overcoming the resistance to assigning an ET to the Engineering Department, and (4) the cost of training the Engineering Department officer to oversee a significant change in the MK rating's responsibilities.

We recommend that the Coast Guard take the following actions:

- Assign a single headquarters office responsibility for all maintenance policy affecting propulsion, auxiliary, and naval engineering electronics equipment and systems.
- Assign a single individual responsibility for all unit-level maintenance for propulsion, auxiliary, and naval engineering electronics equipment and systems and give that individual direct control over the personnel needed to maintain the equipment and systems.

RELATIONSHIP BETWEEN MISSION PERFORMANCE AND EQUIPMENT

Findings

The relationship between aircraft equipment and mission capability is clear and unequivocal and is established through a two-part process. First, the project manager identifies airframe configuration items for each type of aircraft and records them in ACMS. Second, headquarters identifies those aviation systems critical to safety of flight and mission performance. When a safety-of-flight system fails, the aircraft is grounded and is placed in a not mission capable (NMC) status while it awaits maintenance action, test flights, or spare parts. Failure of other systems, while not grounding an aircraft, can limit the missions that the aircraft can perform. The parts required when an aircraft is grounded or missions cannot be performed are highlighted by their association with the aircraft's NMC supply (NMCS) status. That status generates a sense of urgency at all organizations in the aviation community to obtain the requested item of supply.

Conclusions

The nonaviation community can emulate the aviation concept of standardizing for each type of aircraft the minimum equipment required to remain operational and perform its assigned missions by defining the relationship between critical equipment and aircraft mission performance. In fact, the Coast Guard has already taken action on the prerequisites required to implement this aviation concept by implementing configuration management for six cutter classes. The integrated logistics overhaul (ILO) and Extended ILO/Configuration Review processes have accurately identified and recorded cutter configuration items for various cutters. G-ELM is completing plans to expand its use for all cutters authorized to implement configuration management.

Additionally, the nonaviation community has developed several different approaches for relating vessel equipment to support requirements and to mission performance. These actions, although not fully integrated or enhanced for Coast Guard-wide use, include the following:

- The Wiman study,[4] although it primarily focused on those equipments that should be supported, indirectly established some determination of equipment criticality by selecting those equipments that would be centrally supported by Supply Center Curtis Bay (SCCB). However, that selection focused more on supportability than criticality in that it took into account that equipment SCCB was supporting and those it believed it could adequately support in the future.
- In COMDTINST M3501.20,[5] a set of decision aids is given for use in assessing the readiness of 378-foot high-endurance cutters (WHECs). (Similar decision aids are published for other cutter classes.) These decision aids highlight the systems and equipment required for the 378-foot WHEC to perform its assigned missions at different unit readiness levels. However, the decision aids are not intended to identify the minimum equipment required to get underway and perform specific missions.

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[4]The Wiman study was initiated in June 1985 to define the Ship's Inventory Control Point (SICP) (now the Supply Center Curtis Bay) support-level capabilities. Commandant Instruction (COMDTINST) 4400.16, *Limited Decentralization of Hull, Mechanical and Electrical (HM&E) Supply Control*, 26 September 1986, identified 18 vessel classes that were dropped from centralized HM&E supply control. Commandant Notice 4400, *Ships Inventory Control Point (ICP) Support Level Requirements*, 10 February 1988, identified the centrally supported vessel classes and described the SICP's plan for implementing support for selected shipboard equipment and systems.

[5]COMDTINST M3501.20, *The 378' WHEC Readiness Assessment Decision Aids*, 17 September 1985.

- The casualty reporting system provides Coast Guard-wide notification that critical shipboard systems are not operational. However, each Commanding Officer is free to decide which shipboard systems are "critical." As a result, in some cases, a Commanding Officer believes mission performance cannot proceed and submits a Casualty Report (CASREP) when a given equipment fails; in other cases, the same equipment may fail and the Commanding Officer believes the mission can still succeed and does not submit a Casualty Report (CASREP). These inconsistencies occur because the Coast Guard has no standards to determine which equipment is critical to mission performance. Thus the operational commander, the MLCs, and the supply center have difficulty determining the criticality of any maintenance or supply request and establishing the urgency of response to the request. They can only estimate the impact of a given CASREP in limiting the unit's capability to meet its planned performance specification and multiple mission capability. Figure 2-4 compares the sense of urgency experienced in the aviation community with that experienced in the Fleet in obtaining needed materiel or performing maintenance assistance.

Recommendations

We believe those approaches – the Wiman Study, the cutter readiness assessment decision aids, and the CASREP system – offer the potential to relate mission performance and equipment criticality, and we recommend that the Coast Guard reexamine them for that purpose. However, the review should be directed first toward developing a single logical approach to establishing the clear relationship between equipment and mission performance. That logical approach would then be integrated into decision rules for maintenance and supply response and into the design of readiness and casualty evaluation systems.

Fleet adoption of the aviation concept of clearly relating mission performance to equipment capabilities requires the following modifications to nonaviation responsibilities, roles, and organizational structure:

- The Coast Guard's Office of Law Enforcement and Defense Operations (G-O); Office of Engineering, Logistics and Development (G-E); and Office of Command, Control, and Communications (G-T) should agree on a platform's basic design capabilities and the extent to which those capabilities have to be operational to meet the minimum performance level, i.e., what has to be operating at specification level to get underway.

- G-O, in conjunction with the program directors of the Office of Navigation Safety and Waterway Services (G-N) and the Office of Marine Safety, Security and Environmental Protection (G-M) programs should agree on which of the equipments placed onboard have to be present and operational

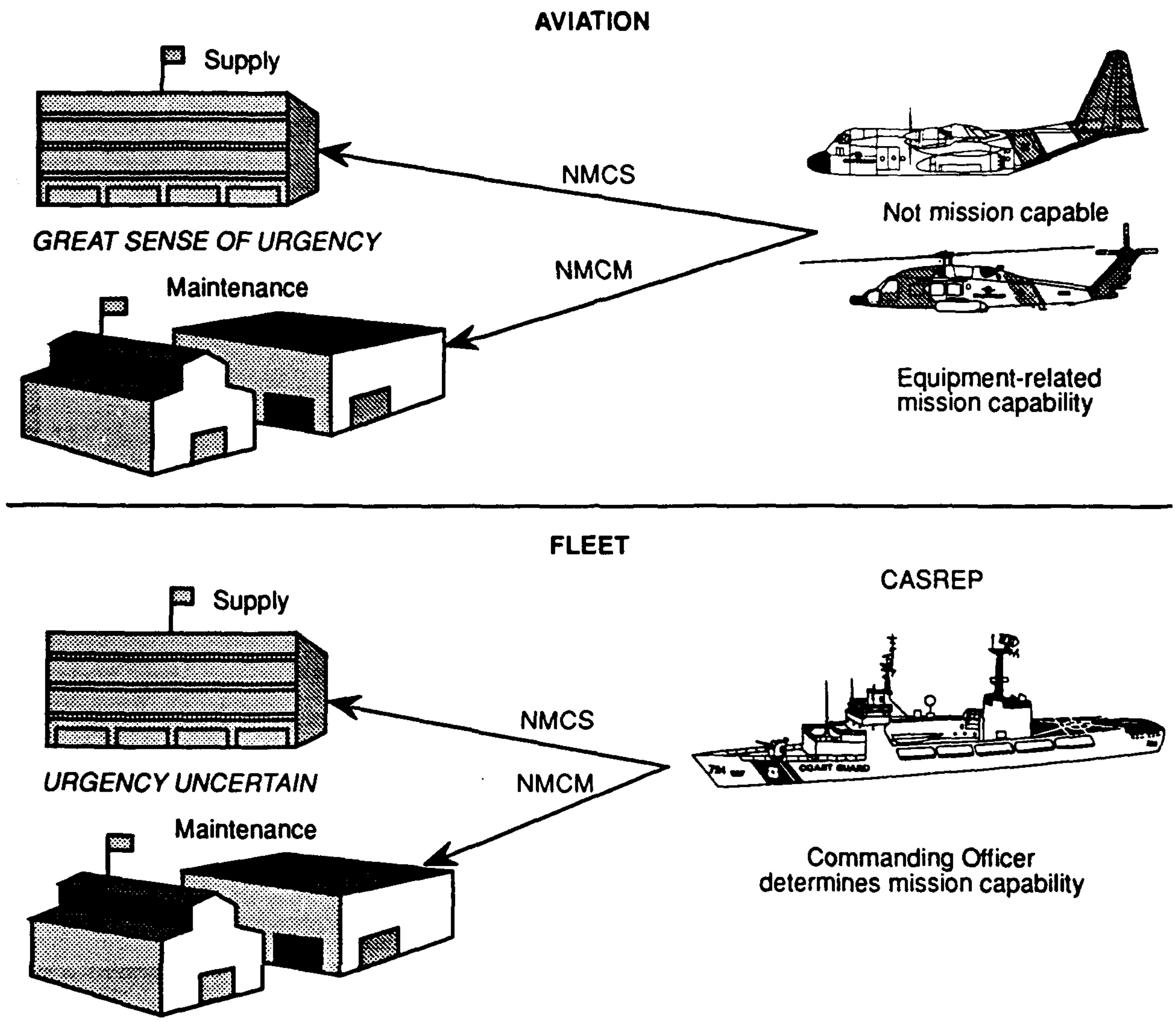

FIG. 2-4. AVIATION VERSUS NONAVIATION RELATIVE URGENCY TO OBTAIN MATERIEL

to meet the minimum mission level, i.e., which equipment or systems need to be operating at specification level for the unit to perform each of its multiple missions.

- G-O should establish performance indicators that would be used by the cutters to determine the degree to which any given cutter is capable of performing each of the missions it has been assigned. Each cutter should record and report its capability to perform each of its assigned missions by comparing itself with the G-O minimum performance capabilities. Initially, the MLCs should assist the units in implementing performance measurement, and subsequently should be tasked with compliance inspections.

We recommend that the Coast Guard establish and implement uniform measures for each cutter class to relate equipment to operating performance and operating performance to mission capability. Figure 2-5 shows that the Coast Guard's existing structure is well suited to implementing this policy recommendation. The area command can utilize unit performance data to optimize the selection of units for particular underway missions, the supply centers can be more responsive to unit requirements, and the MLCs can take rapid action to correct unit requirements.

IMPROVED VISIBILITY OF AIRCRAFT CAPABILITY THROUGH CENTRALIZED MAINTENANCE REPORTING

Findings

Data on maintenance planning and execution can be centrally recorded and reported with the ACMS. Air stations obtain maintenance data and report maintenance completion to a central data base. Aviation's centralized reporting of maintenance data makes the following actions possible:

- *Selection of most mission-capable asset for given assignment.* Air stations are able to select the most mission-capable aircraft to perform any given assignment because each aircraft's outstanding maintenance requirements are reported. For example, the aviation community chooses the best aircraft for remote site or shipboard deployment by reviewing applicable aircraft for overdue/outstanding maintenance as well as upcoming maintenance requirements for each aircraft. By comparing aircraft, the air stations are able to select the one most likely to complete the assignment successfully.

- *Selection of best asset for extended availability.* Accessibility to centralized maintenance data enhances the process of selecting the most appropriate asset to place in programmed depot maintenance (PDM).[6] By knowing each aircraft's outstanding and upcoming maintenance requirements, maintenance needs can be matched against maintenance capabilities available for any given PDM period, and the most appropriate asset can then be assigned to PDM.

- *Revision of mandatory allowances based on usage history.* Aircraft maintenance history can be used by the supply system to revise mandatory allowance items and quantities based on actual consumption data.

[6]Aircraft are periodically inducted into depot maintenance for PDM. Performed at the AR&SC, PDM consists of overhauling and making major repairs and modifications to aircraft and aeronautical equipment.

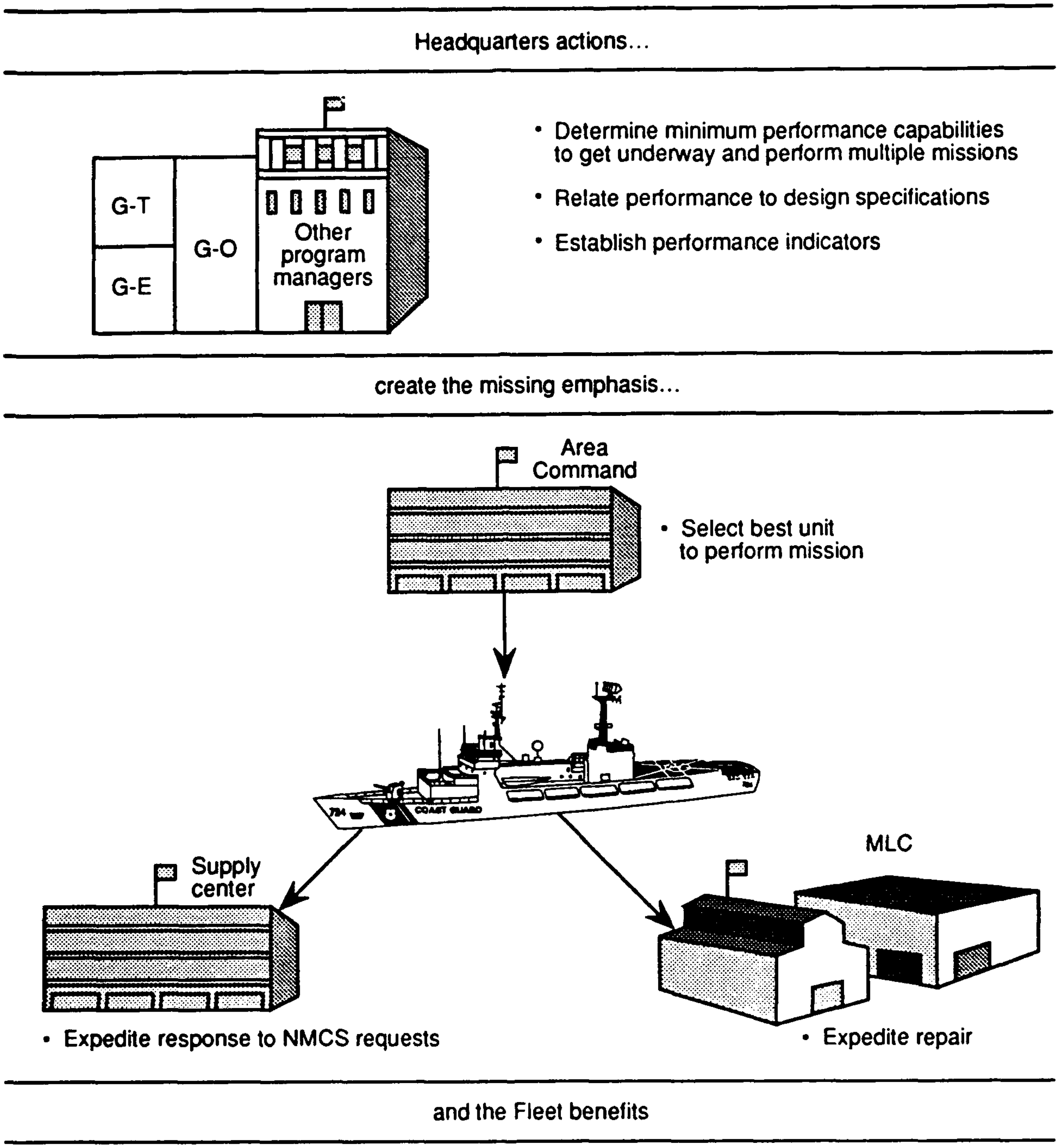

FIG. 2-5. RELATING EQUIPMENT TO OPERATING PERFORMANCE AND OPERATING PERFORMANCE TO MISSION

- *Maintenance of specific component historical records.* The aviation community maintains significant historical records on all components designated to be tracked by serial number because those data are particularly useful in troubleshooting components with unusually high failure rates.

- *Anticipation of repair part requirements.* While the aviation community is not currently able to link supply and maintenance data bases and AMMIS specifications do not clearly require it, we believe AR&SC could anticipate requirements for given parts through knowledge of aircraft maintenance actions coming due. AR&SC could initiate action to obtain needed materiel in advance of actual unit requirements so that a greater percentage of air station requisitions could be filled without delay.

The principal feature of centralized maintenance recording and reporting is the routine daily forwarding of each air station's maintenance history to a central data collection facility. Data are collated and made available in various formats to Headquarters, AR&SC, and the air stations themselves.

Conclusions

Many of the reasons cited for centralized reporting and recording of aviation maintenance data are also applicable to the nonaviation community. To implement such centralization, vessels must forward maintenance information to a central maintenance collection point as the maintenance is completed. However, to date, G-E and G-T have not established any Coast Guard policies that require such centralized reporting. The maintenance data could be used by naval engineers, supply managers, and operations planners for the following purposes:

- To establish unit maintenance performance measurement indicators
- To help select vessels for routine and special underway assignments
- To revise reparable and repair part allowance levels based on maintenance history
- To anticipate repair part requirements to support maintenance actions
- To maintain historical records on critical components.

Recommendations

We recommend that the Coast Guard establish policies that require each vessel to report needed and completed maintenance actions to a central maintenance data collection point for use in managing maintenance and supply requirements and assigning underway missions. We further recommend that the Coast Guard take the

following actions with respect to centralized reporting and recording of Fleet maintenance data (see Figure 2-6):

- G-ELM, G-ENE, and G-TES should jointly sponsor and fund a program to centrally report and record unit maintenance data. Both the MLC Atlantic (MLC LANT) and the MLC Pacific (MLC PAC) should implement systems to facilitate the central collection, assimilation, and reporting of unit maintenance data.

- Units should have ready access to planned maintenance [both preventive maintenance system (PMS) and current ship's maintenance project (CSMP)] that is coming due or is overdue, corrective maintenance awaiting completion, and all previous maintenance completed. The MLCs and Area Commands should have ready access to CSMP coming due, overdue, and completed for all units for which they have maintenance responsibility. The MLCs and area commands can combine operational requirements with CSMP coming due in order to select the best assets to perform given missions.

- The maintenance data base should be structured to help each Coast Guard organization obtain selected maintenance information in a form and format it can best use.

INVENTORY MANAGEMENT STRATEGIES TAILORED TO CRITICAL NEEDS

Having implemented meaningful item-of-supply urgency indicators by accurately relating safety-of-flight and aircraft mission performance to equipment, the aviation community tailored inventory management strategies to maximize the availability of critical aviation materiel.

Findings

The aviation community implemented its overall inventory management strategy by first creating the concept of materiel type codes and defining the criteria to use for assigning type codes (1 through 6) to each item. It then determined the management intensity that should be applied to each materiel type, developing and applying inventory-intensive management techniques to the most critical materiel. Table 2-1 presents definitions for each type code.

By reviewing each aviation item and assigning it to an inventory materiel type, the aviation community is able to vary the management intensity applied to particular items. For example, Type 1 materiel receives the most intense manage-

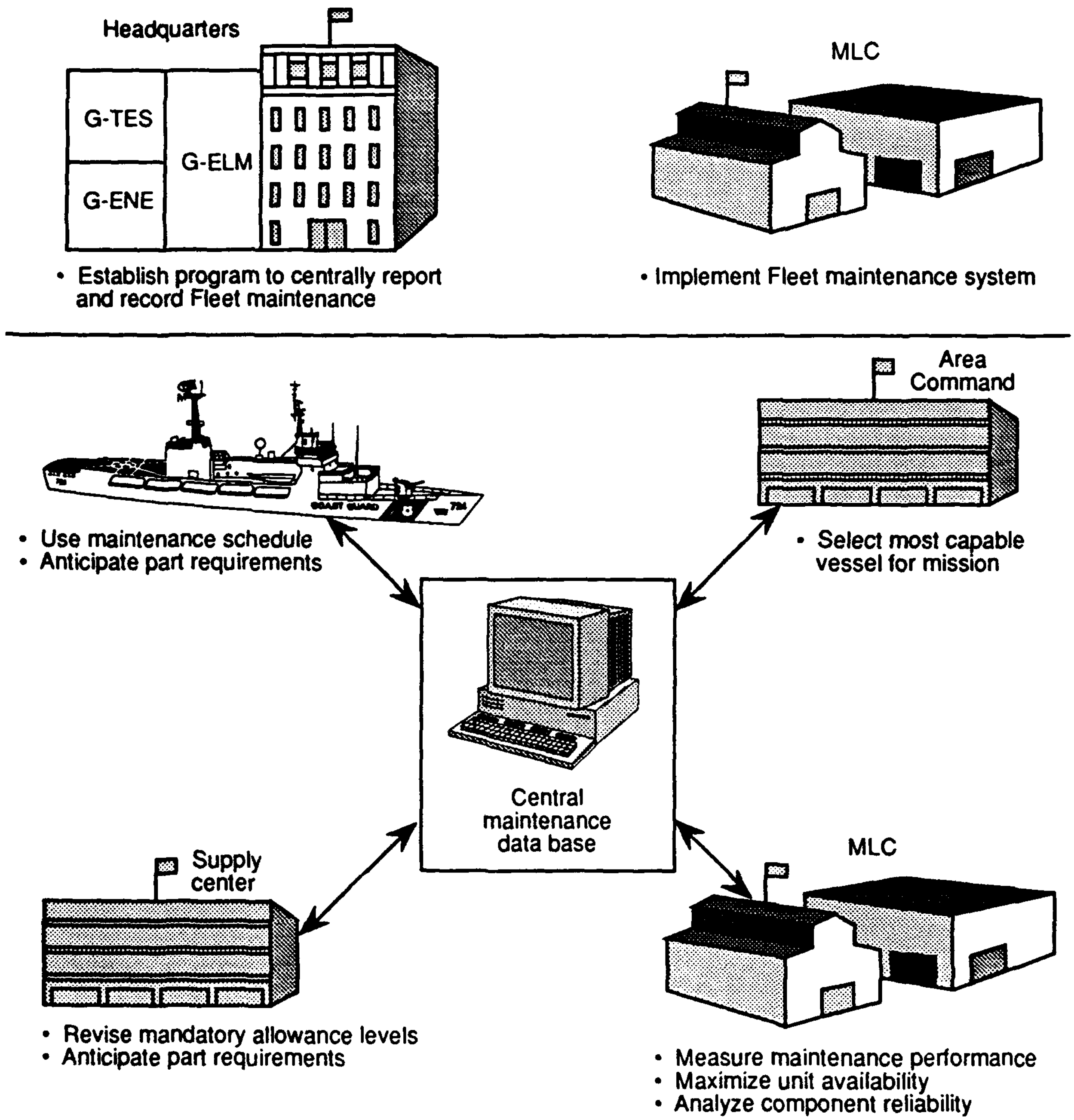

FIG. 2-6. FLEET USES FOR CENTRAL MAINTENANCE DATA AND ACTIONS REQUIRED FOR ITS IMPLEMENTATION

ment through a nonautomated (manual), off-line tracking-and-control system. AR&SC automatically replaces items categorized as Type 2 or 4 on a one-for-one basis; i.e., an automated replenishment action is triggered by the air station's inventory management system to replace a Type 2 or 4 item issued to its maintenance shop.

TABLE 2-1

AVIATION MATERIEL TYPES

Type	Materiel type definition
1	Aeronautical materiel managed by serial number: it includes aircraft engines, high-value components, items requiring special configuration control procedures, and high-cost/low-volume items in critical supply
2	Aeronautical materiel, less avionics, that either has a unit price in excess of $50, is Coast Guard managed, is mandatory allowance OGA materiel, or is difficult to procure at the unit level
3	Aeronautical materiel, less avionics, with a unit cost less than $50 and easily procurable from an OGA or commercial source
4	Avionics materiel that is either reparable or has a unit cost of more than $200
5	Consumable avionics materiel with a unit cost less than $200
6	Ground support equipment

Additionally, the aviation community's inventory strategy makes possible implementation of inventory-intensive management techniques. Two of those techniques, "parts pooling" and "diversion of parts," illustrate how urgent needs get special attention. These inventory-intensive management techniques operate as follows:

- *Parts pooling.* AR&SC maintains visibility of all materiel stocked at Coast Guard air stations and included in the air station unit allowance lists (CG298).[7] Further, AR&SC provides funds for all unit mandatory allowances for both initial stockage and subsequent sustaining support requirements; for those reasons, AR&SC is able to facilitate parts pooling among air stations. When an air station urgently needs an item that is not in stock at either the requesting air station or AR&SC, AR&SC uses the SASI or automated information system to determine whether the needed item is in stock at any other Coast Guard air station. If it is available, AR&SC initiates the transfer from one air station to the other.

[7]The CG298 is an air station unit allowance list of the items and quantities of those Types 2 and 4 items authorized for mandatory stockage. It also contains a recommended list of Types 3 and 5 materiel that each air station has discretionary authority to stock.

- *Diversion of parts to most critical need.* All requisitions for CG298 materiel are sent to AR&SC. AR&SC also initiates stock replenishment action automatically for deficient air station inventory balances. Thus, AR&SC can monitor all items requisitioned and commercially procured. Additionally, AR&SC inventory managers have the authority to divert backordered items to air stations having the most critical need. Such stations are identified through, for example, the NMCS identification process, informal communications, or the inability of a given air station to fulfill its BRAVO ZERO commitment.[8] Under those circumstances, AR&SC diverts incoming materiel from its original destination to the air station with the more urgent need.

Conclusions

Inventory-management strategies that concentrate on satisfying urgent requirements are particularly appealing to the nonaviation community. The concept of establishing type codes to focus management attention is readily applicable to the Fleet. Combined with relating mission performance to equipment, implementing such inventory management strategies can improve overall Fleet availability. Figure 2-7 shows two examples of the process now used by nonaviation supply centers and OGAs to satisfy not-in-stock shipboard requirements and the downtime that could result.

Recommendation

We recommend that the nonaviation community implement a materiel-type coding structure as the foundation for inventory-intensive management techniques. We recommend that the following changes in Fleet responsibilities, relationships and roles, and organization structure be made to implement a materiel-type coding structure and the corresponding inventory-intensive management techniques:

- G-ELM and the nonaviation supply centers should coordinate with G-E and G-T to develop Coast Guard policies that establish and implement the use of nonaviation materiel-type codes and require the nonaviation supply centers to classify all nonaviation materiel into the assigned type codes.
- To better satisfy units' critical requirements, the Coast Guard nonaviation supply centers should develop an asset visibility, funding, and control system that supports the use of inventory-intensive management techniques such as parts pooling and the diversion of parts to the most critical need.

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[8]BRAVO ZERO is the commitment placed on each air station to be capable of launching at least one aircraft within 30 minutes to perform any of the missions assigned to the given air station.

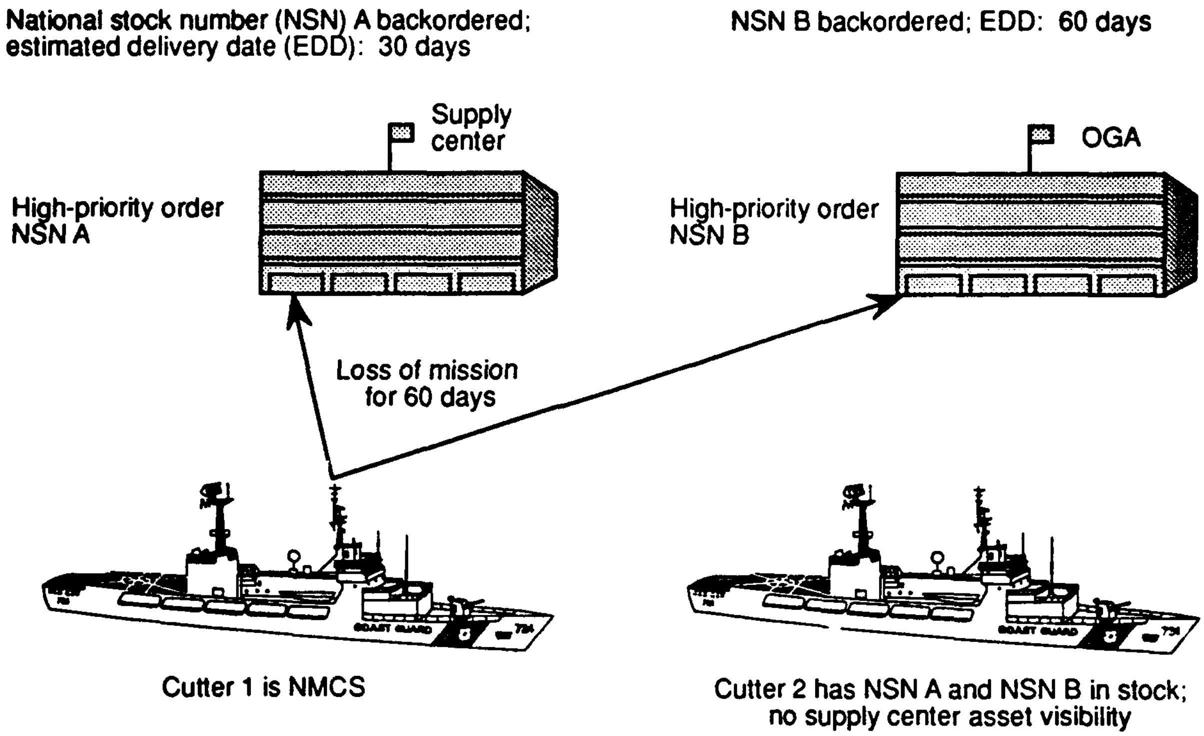

FIG. 2-7. CURRENT PROCESS TO SATISFY VESSEL NMCS REQUIREMENTS

- As a unit identifies a critical NMCS requirement, the supply centers should search their own stockage locations and other Coast Guard units to determine whether the required item is available. If it is not available either internally or from another unit, the supply centers should determine whether an outstanding procurements exists. If it does, the item, when available, should be diverted to the most critically needed location.

- The Coast Guard should implement the organization structure we recommended in Appendix B of our report, *Improving Shipboard SupplyManagement in the Coast Guard.*[9] Controlling and redistributing critical unit assets will be facilitated by implementing materiel management detachments (MMDs) and stocking the intensively managed items at the MMDs. Figure 2-8 shows how implementation of parts pooling combined with the above changes could improve Fleet mission availability.

[9]LMI Report CG701R1, op. cit.

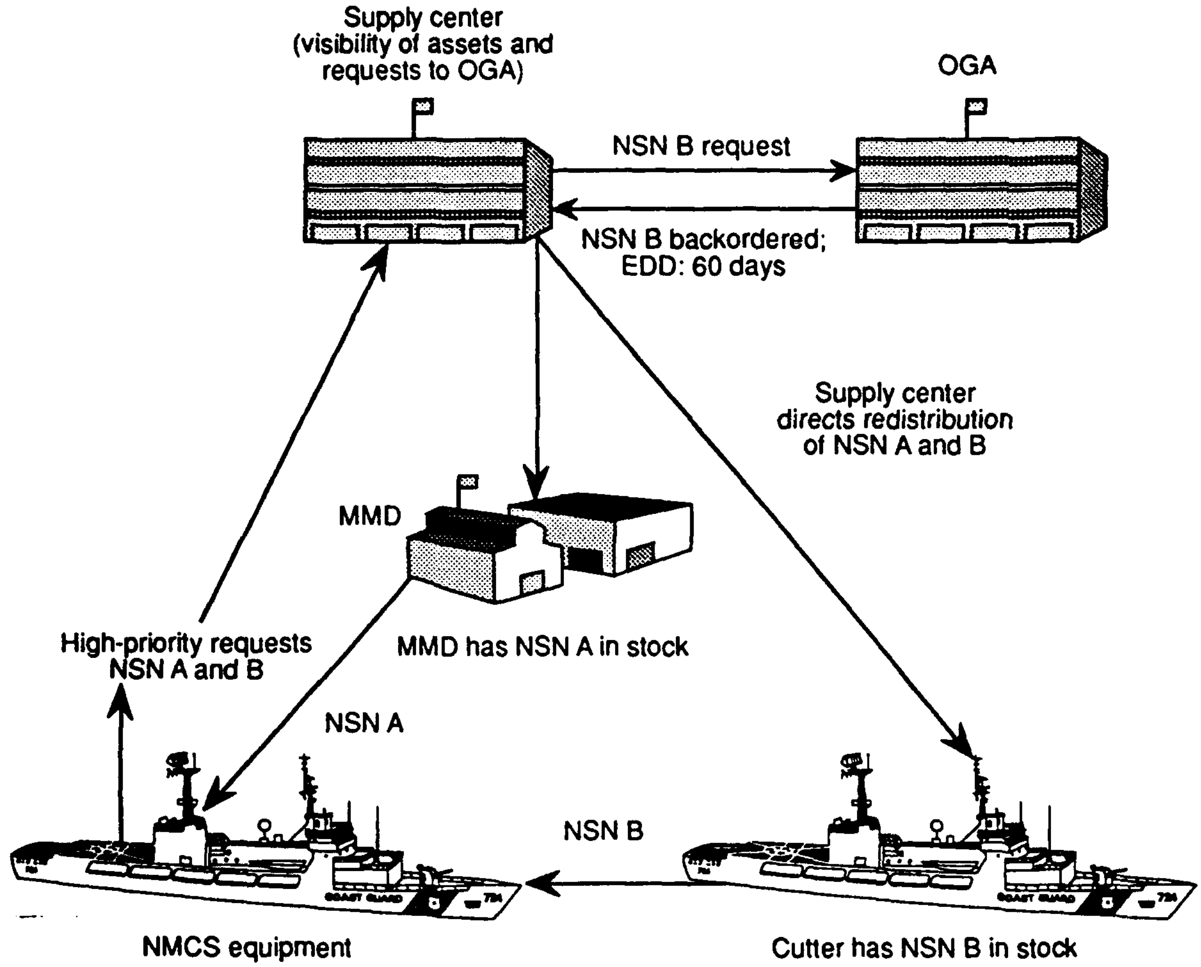

FIG. 2-8. INVENTORY-INTENSIVE MANAGEMENT TECHNIQUES CAN MINIMIZE VESSEL DOWNTIME

EFFECTIVE BUDGETING FOR SUSTAINING SUPPORT

Findings

The aviation community budget preparation process effectively packages sustaining support. The aviation community requests funds for the upcoming fiscal year by budgeting a predetermined number of flight hours per year per aircraft. The number of flight hours is usually broken out by aircraft type. G-OAV prepares a budget for the number of requested flight hours by preparing a package of costs (i.e., sustaining support and fuel) for the given number of flight hours. G-OAV then compares the amount of the eventual appropriation with the amount requested and

determines the number of hours each aircraft can fly that year. This information is promulgated and funds are transferred to the appropriate headquarters office for distribution.

Conclusions and Recommendations

Implementation of the aviation community's specific budget preparation process would not be practical in the nonaviation community. Many of the roles and responsibilities of the nonaviation community are best accomplished through a multilayered approach in which headquarters, MLCs, districts, and the units themselves all have budget and finance responsibilities. We recommend that the Fleet's budget preparation process include the following features:

- For initial procurements and provisioning, separate headquarters responsibilities for electronic systems and propulsion/auxiliary systems should continue until combined under a single Fleet logistics management unit.
- District and MLC maintenance offices, as appropriate, should directly budget and fund Fleet maintenance requirements, including contracting for work beyond either the maintenance capability or funding authority of the unit.
- As recommended in our report, *Improving Shipboard Supply Management in the Coast Guard*,[10] MLCs should centrally fund mandatory allowances.
- Unit Commanding Officers should continue to exercise discretionary authority over AFC-30 fund utilization;[11] however, as recommended in the supplement to our report[12] and as currently being implemented by the Coast Guard, G-ELM should provide Headquarters staff-level review of AFC-30 budget requests for supplies and equipment that are prepared at the unit level and submitted through the area command facility managers to headquarters.

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[10]LMI Report CG701R1, op.cit.

[11]AFC-30 is an appropriated funds category for unit-level operating costs.

[12]LMI Report CG701R1 Supplement, *Focusing Planning for Supply Management: Objectives, Policies, Oversight and Review*, George L. Slyman, et al., April 1988.

DESIGNATION OF PRIME UNIT AS TECHNICAL RESPONSIVENESS LINK TO FIELD

Findings

The aviation community designates a "prime unit" to "ensure a centralized point for technical responsiveness to field level maintenance management of a specific aircraft type."[13] Prime unit review of unit maintenance management practices includes the following:

- Reviewing and correcting noted deficiencies in technical manuals
- Recommending maintenance changes to G-EAE
- Verifying the accuracy of time compliance technical orders (TCTOs)
- Participating in aircraft maintenance review conferences
- Acting as a single point of contact to aircraft manufacturers
- Determining the prevalence of maintenance deficiencies.

The effectiveness of the prime unit is measured by its ability to provide the field with technical solutions that reflect knowledge and experience superior to that of field maintenance personnel. Both the breadth and depth of technical expertise required in the designated prime unit necessitate careful selection of the key individual who heads the prime unit and is expected to satisfactorily complete the wide array of responsibilities assigned.

Conclusions

The prime unit concept is directly applicable to cutter operations. Establishing for each cutter class a single point of maintenance expertise that is technically responsive to unit maintenance management concerns would improve the Fleet's ability to standardize maintenance practices; continuously review and maintain up-to-date technical manuals; and coordinate the review, approval, and implementation of configuration changes.

Additionally, establishing single points of technical responsiveness for Coast Guard boats would offer many of the same advantages. However, determining the feasibility of implementation at the boat level requires further detailed investigation similar to that conducted for the proposed concept of establishing a lead area for

[13]COMDTINST M13020.1B, *Aeronautical Engineering Maintenance Management Manual.*

cutters. The following questions are typical of questions that must be addressed in evaluating and identifying where and how to establish single points of technical responsiveness for Coast Guard boats:

- Should each district designate its own point of technical responsiveness for each boat class?
- Should a lead area be designated for each boat class and should that lead area be responsible for identifying the points of technical responsiveness?
- For naval engineering, what is the best way to decide where the technical expertise for each boat class resides?

Recommendations

We recommend that for each cutter class, the MLCs establish single points of technical responsiveness for field-level maintenance management. G-ENE's previously developed draft proposal for lead areas should be updated, coordinated, and published to implement the single technical responsiveness points concept consistent with the prime unit roles in the nonaviation community. We recommend that the points of technical responsiveness be assigned the following responsibilities:

- Act as single point of contact to vessel manufacturer
- Review and correct technical manuals
- Develop contract specifications for repair and overhaul
- Perform maintenance troubleshooting and determine the extent of corrective maintenance deficiencies
- Evaluate repair and replacement plans
- Develop item specifications and identify sources of supply for non-NSN parts.

Additionally, we recommend that the Coast Guard analyze the applicability of the prime unit concept to small boats and develop a similar draft implementation plan for review by the districts and MLCs.

EFFECTIVE MANAGEMENT OF CONFIGURATION CHANGES

Findings

In the aviation community, configuration changes are approved at Headquarters, implemented at AR&SC, and coordinated by and through G-EAE. The Aircraft Configuration Control Board (ACCB), which consists of Headquarters (G-EAE and G-OAV), AR&SC, and unit representatives, evaluates component data and determines whether changes are required because of "safety, operational necessity, logistics necessity, or increased effectiveness (other modifications that improve efficiency or reduce costs)."[14] ACCB-recommended changes are forwarded for final approval to the Chief, G-OAV and Chief, G-EAE. Once a decision is made to implement an aviation configuration change and appropriate Headquarters approvals are obtained, AR&SC is tasked with managing change implementation. AR&SC is responsible for preparing the change notice, initiating the required procurements to obtain both alteration materiel and initial supply stock, determining the changes to unit allowance lists, and obtaining the revised technical documentation. This configuration control process ensures that, regardless of the commodity, consistent standards are applied in the evaluation of potential alterations and in their subsequent implementation.

Conclusion

Aviation's process for managing configuration change has general applicability to the nonaviation community; however, consistent with our recommendation on the multilayered maintenance management organization structure, we believe the nonaviation community must take a more decentralized approach until electronics and naval engineering maintenance management are combined under a single Fleet logistics support organization. A Fleet Configuration Control Board similar to the ACCB could be beneficial. Again, consistent with our earlier recommendation to establish the MLCs as single points of maintenance expertise for each cutter class, we believe MLCs should be responsible for coordinating configuration changes applicable to their respective cutter classes. The Fleet Configuration Control Board should consist of Headquarters representation (G-TES, G-ENE, and G-ELM, as appropriate), the MLC for the given cutter class, supply centers (Supply Center Brooklyn or Supply Center Curtis Bay, as appropriate until a single MMC is

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[14]COMDTINST M13020.1B, op. cit.

established), and units (if relevant). Upon final approval of a given configuration change, the MLC should manage the change implementation.

Recommendation

We recommend that the Coast Guard streamline the Fleet configuration change approval and implementation process consistent with the recommended central maintenance policy, planning, and technical assistance structure.

SUMMARY

Table 2-2 lists the integrated logistics support concepts discussed in this chapter and summarizes their use by the aviation and nonaviation communities in the Coast Guard. Table 2-3 presents those support concepts and summarizes our recommendations for adoption by the nonaviation community.

TABLE 2-2

COMPARISON OF CURRENT SUPPORT CONCEPTS OF THE AVIATION AND NONAVIATION COMMUNITIES

Integrated logistics support concepts	Aviation community	Nonaviation community
Resource allocation	Based on "safety of flight" and sound business practices	Based on management estimates of minimum needed to "get underway"
Technical channel	Streamlined channel for information, decision making, and advice	Multilayered channel for information, decision making, and advice
Maintenance management	Central control of maintenance performance	Divided control of maintenance responsibilities between electronics and naval engineering systems
Relationship between mission performance and equipment	Known and identifiable relationship	Determined at discretion of commanding officer; attempts to relate (Wiman study, readiness decision aids, CASREP system) not aggressively pursued or expanded to Coast Guard-wide use
	Established urgency to complete maintenance and supply actions	Variable urgency caused by competing priorities
Centralized maintenance reporting and recording	Applicable and implemented	Applicable and not implemented
Inventory management strategies	Tailored strategies target urgent requirements; materiel-type coding structure promotes varying management intensity	Tailored strategies underutilized; materiel-type coding structure not implemented
	Inventory strategy promotes use of inventory-intensive management techniques to maximize availability	Inventory strategy does not promote use of inventory-intensive management techniques
Budgeting process	Effectively packages sustaining support	Decentralized process for budgeting sustaining support
Technical responsiveness link to field	Central point for each aircraft type (prime unit)	No central point for each cutter class; lead area proposed
Configuration change process	Streamlined process for development, approval, and implementation	Complex process being considered for revision

TABLE 2-3

FLEET RECOMMENDATIONS

Integrated logistics support concepts	Recommendations
Technical channel	Retain multilayered maintenance management technical channel while electronics and naval engineering are separate organizational entities at MLCs and shoreside support units. However, future organization changes should combine electronics and naval engineering maintenance management. Continue to plan establishing one MMC, i.e., a Fleet logistics management center, consolidating the supply center and Headquarters' supply planning, maintenance planning, and maintenance engineering functions.
Maintenance management	Assign a single Headquarters office responsibility for all maintenance policy affecting propulsion, auxiliary, and naval engineering-related electronics equipment and systems; assign a single individual responsibility for all unit -level maintenance for those equipment and systems, and give that individual direct control over the personnel needed to maintain the equipment and systems.
Relationship between mission performance and equipment	Establish and implement uniform measures for each cutter class to relate equipment to operating performance and operating performance to mission capability.
Centralized maintenance reporting and recording	Establish policies that require each vessel to report needed and completed maintenance actions to a central maintenance data collection point for use in managing maintenance and supply requirements and assigning underway missions to cutters.
Inventory management strategies	Implement a materiel-type coding structure as the foundation for inventory-intensive management techniques.
Budgeting process	Continue to develop the budget process consistent with the multilayered organizational structure until future organization changes establish a combined logistics support management for electronics and naval engineering materiel. Implement previous recommendations on centrally funding mandatory allowances and providing Fleet supply and equipment budget requests to the Commandant (G-ELM) for staff-level review.
Technical responsiveness link to field	Establish for each cutter class a single point of technical assistance for field-level maintenance. Analyze extending aviation's prime unit concept to small boats and develop a draft implementation plan for review by the districts and MLCs.
Configuration change process	Streamline configuration change approval and implementation process consistent with the recommended central maintenance policy, planning, and technical assistance structure.

CHAPTER 3

SAIL-RELATED LESSONS LEARNED

INTRODUCTION

In the course of our analysis of the applicability of AMMIS to the nonaviation community, we examined the overall environment in which AMMIS is being developed, including the aviation information systems hardware, software, and communications environment; the aviation organizational structure; and the roles, responsibilities, and relationships within and among aviation organizations. Our objective was to determine how the system environment, organizational structure, and organization roles and responsibilities affected AMMIS development and whether any "lessons learned" could be applied to the SAIL program. From our analysis, we learned the following lessons that we believe directly relate to the development of SAIL:

- System design is limited by the reality of the environment in which it must operate.
- Organizational differences can affect how software applications are utilized.
- Functional managers need advanced-techniques training to use the system capabilities effectively.
- Configuration control boards are needed early to monitor functional requirements and application integration planning.

In this chapter, we present the lessons learned in their AMMIS context, relate them to the Fleet, and provide recommendations on how the SAIL program should address them as system development proceeds.

AMMIS HARDWARE AND SOFTWARE ENVIRONMENT

Findings

The aviation community's streamlined technical channel support concept underlies its decision to run AMMIS applications on a central host computer located at AR&SC. Access to the host computer is available through any Coast Guard

standard workstation running a personal computer (PC) communications software package with VT100 emulation and a 2400-baud modem. All data are resident in the host computer. Menu-driven data request formats are available on air station standard terminals for requesting data from the host computer. The host computer executes all requests for data and transmits those data to the air stations' terminals over a high-quality communications network. As a result of the decision to service air stations from the AR&SC host computer, air stations are limited to requesting only that information available from the AMMIS menu. Data transmitted from the AR&SC host computer are available only in standardized output formats approved for AMMIS use. Treating the standard workstation as a "dumb" terminal limits the capability for interactive editing, i.e., the capability to validate the accuracy of data and data relationships while transactions are being created. Additionally, the VT100 emulator lengthens response times if the host computer is on line with the standard workstation for interactive editing. Finally, AMMIS is limited in its ability to take advantage of technological advances such as those contributing to greater use of distributed processing. Figure 3-1 shows the various ways in which this limitation affects AMMIS.

Two significant factors contribute to the decision to process all data on the AR&SC host computer:

- The aviation community's inventory management strategy and short technical channel for maintenance management both streamline decision making and dissemination of information by centrally recording and reporting maintenance and supply data. The AMMIS processing environment is an outgrowth of this general philosophy.

- Air station automatic data processing (ADP) expertise is not consistently available to maintain either the standard workstation or operating software. The result is ADP capability varying greatly among Coast Guard air stations. The principal reason for the inconsistent air station ADP capability is that the Coast Guard has not implemented unit-level ADP shops and rates.[1] At some air stations, pockets of ADP expertise exist because "unofficial" ADP rates and shops have been implemented. At those

[1]COMDTINST 5230.40, *Coast Guard Standard Workstation System Management and Support*, dated 31 May 1990, recognizes the Coast Guard awareness of this problem. The instruction establishes policy for standard workstation management and support, including implementation of a data processing (DP) rate for the Coast Guard reserves. It also establishes a plan for implementing ADP training commensurate with given standard workstation responsibilities.

locations, an ad hoc ADP system development capability is emerging. At other air stations, ADP capability is limited.

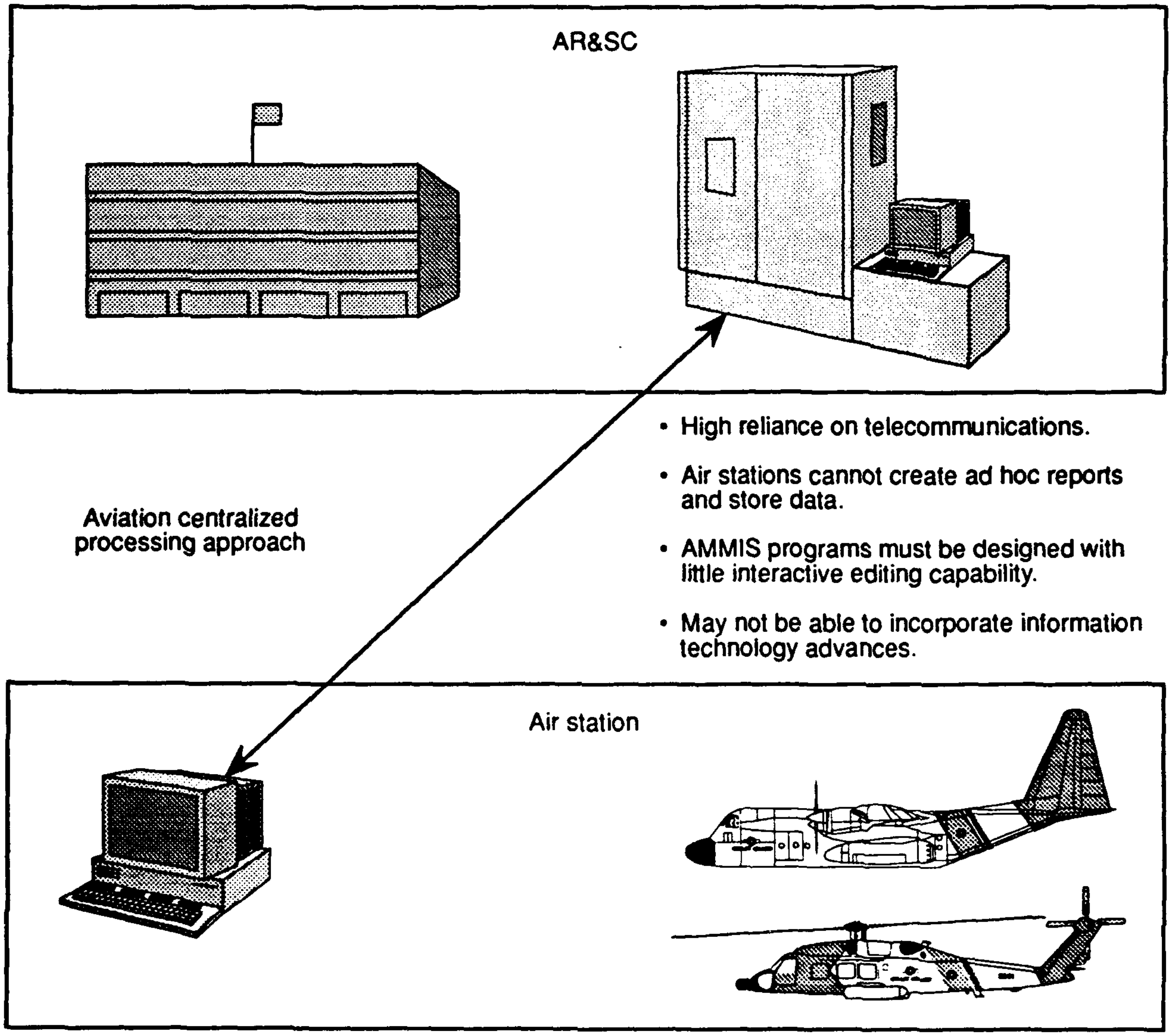

FIG. 3-1. EFFECT OF CENTRALIZED PROCESSING APPROACH ON AMMIS

At those air stations that have an "unofficial" ADP expertise, we reviewed several different ad hoc reports that provided additional supply management information not available from SASI. However, none of these air stations has a methodology for exporting the ad hoc programs to other air stations or even for

ensuring that the programs could be maintained after the developer is transferred to a new duty station.

From a G-EAE and G-ELM perspective, these localized ADP development efforts occurring without formal Headquarters oversight have the following implications:

- Because they are uncontrolled development efforts, standardized applications are not used.
- They are development efforts with no continuity.
- They divert ADP skills and training.
- They constitute a loss of ADP development direction.
- The Coast Guard cannot capitalize on those ADP initiatives.

Conclusions

The disparate levels of standard workstation ADP expertise we found among Coast Guard air stations also exists among vessels in the Fleet. Like the aviation community, the Fleet has not implemented vessel-level ADP shops and rates. Additionally, while we expect the actions detailed in COMDTINST 5230.40[2] to provide unit-level capability for routine system operation and administrative support, we do not believe its implementation will result in a sufficient level of ADP expertise to address the range of needs that vessels will experience when SAIL is implemented. The COMDTINST does not adequately deal with how the unit level will achieve sufficient software application expertise, and it does not encourage better local management. Furthermore, it does not allow for Fleet units to possess the necessary ADP expertise to resolve likely standard workstation technical and configuration problems.

If the Coast Guard fails to address these issues, the automated systems are not going to be as responsive as possible to the user/operator's special requirements and system innovations. Furthermore, the user/operator may attempt to resolve a problem by applying a locally developed system change; that change may well increase the problem rather than resolve it.

[2]COMDTINST 5230.40, op. cit.

The Coast Guard must decide whether it will implement the SAIL information system technology that requires little ADP expertise to support and maintain a technology that requires ADP expertise at all organization levels. Making this decision early maximizes the likelihood of successful implementation of the chosen ADP development approach. If the Coast Guard uses technologies that require little expertise, then the SAIL program will experience the same conditions found for AMMIS. If ADP expertise is provided at all levels, SAIL needs to consider the following:

- ADP training should be a primary goal of SAIL implementation.
- Training must ensure the Fleet can properly operate SAIL applications.
- Detailed training programs must be developed early to ensure personnel have the necessary expertise in Fleet ADP systems.

The fact that only 27 air stations have to be supported weighs in favor of AMMIS being centrally controlled. Just as important, the fact that the vessel population is so much greater than the aviation population indicates that an equally large likelihood exists that unit-level problems will occur if the Fleet attempts to implement centralized processing.

We do not believe SAIL should be constrained to utilize only those applications that would require little field ADP expertise to implement and maintain. The large number of units designated to run SAIL applications would best be served through a distributed data processing environment in which each unit stores, processes, and accesses data directly on the standard workstation.

Recommendations

We recommend that SAIL use decentralized processing with distributed capabilities. To ensure the success of such an approach, G-ELM should develop and implement a detailed plan and schedule that ensures the Fleet can properly operate SAIL applications. As G-ELM has previously espoused, such software training should be resident in the applications provided to the Fleet.

We also recommend that G-ELM coordinate with the Chief, Information Systems Division (G-TIS), to enhance COMDTINST 5230.40 so that a unit-level support capability will be available to develop special reports and management

innovations and to resolve standard workstation technical and configuration problems.

IMPACT OF AIR STATION ORGANIZATION ON STANDARDIZED AIR STATION INVENTORY (SYSTEM) UTILIZATION

Findings

The functional requirements document for AMMIS provides details on AMMIS's management of air station supply. That document describes the requirement for AMMIS to maintain air station materiel inventories and stock records, process requests for materiel received from maintenance shops, and initiate action to replenish materiel. Shortly after development of the AMMIS functional specifications, AR&SC began to develop SASI. Coincidentally, SASI incorporated the functional requirements for managing air station supply. As SASI development proceeded, it was subsumed under the AMMIS umbrella, and the SASI specifications became the baseline for preparing the AMMIS air station supply system specifications. The general expectation is that SASI's functional performance will satisfy the AMMIS air station supply function.

The SASI system electronically manages air station inventory and initiates replenishment action to replace materiel issued to maintenance shops. It helps ensure air station CG298 allowance materiel is properly identified and all required materiel is either on hand or on order.

The SASI is a standardized system implemented at 27 air stations;[3] however, it may be used differently at each air station even though all air stations have similar organizational structures. The difference occurs because air stations differ in the responsibilities they assign to the Supply and Engineering Departments and also those they assign to the Aviation Materiel Office (AMO) and the Avionics Division in the Engineering Department.

Within the aviation community, the Supply and Engineering Departments use different personnel ratings to manage aviation materiel. Generally, storekeepers (SKs) are exclusively assigned materiel responsibilities in the Supply Department within the Engineering Department. AEs, aviation machinist mates (ADs), aviation

[3]Of the Coast Guard's 28 air stations, the Washington, D.C., station is the only one that did not receive SASI.

structural mechanics (AMs), and aviation survivalmen (ASM) are assigned to the AMO, and ATs are assigned materiel responsibilities in avionics. Junior-level personnel often are detailed to the AMO from other engineering divisions for up to 6 months at a time. Senior enlisted personnel assigned to the AMO tend to be individuals who have worked in aviation supply for extended periods, in many cases performing these responsibilities for multiple tours. However, differences exist in this generalized assignment pattern. For example, at Air Station Mobile all materiel responsibilities have been centralized in the Engineering Department. That organization was selected because of the general belief that the engineering officer should have direct control of all of the resources needed for aircraft maintenance. Coincident with that assignment of responsibilities was the assignment of senior-rated SKs to manage the AMO.

Table 3-1 shows three examples of the different ways in which aviation materiel management responsibilities are assigned among supply, engineering, AMO, and avionics. In virtually all locations, Types 4 and 5 materiel are managed by avionics. Avionics manages such materiel primarily because the aviation community believes the specialized nature of avionics reparables and repair parts warrants AT oversight and control. At Mobile, the AMO manages Types 2 and 3 materiel. At Air Station Clearwater, the supply department manages Type 2 materiel and the AMO manages Type 3. At Air Station Corpus Christi, the supply department manages Types 2, 3, and 5 materiel. Type 2 materiel is generally assigned to supply because its high-dollar-value, reparable nature is perceived to warrant a high degree of specialized handling and control that can best be provided by SK materiel specialists. Type 3 materiel is often managed by the AMO because it is inexpensive, easy to obtain, and funded by air station AFC-30 funds under the control of the Engineering Department.

These disparate distributions of responsibilities for performing the supply function result in differences in the way the SASI system is used. Two of these differences are the following:

- Even when SASI is physically collocated with inventory management and storage personnel, differences in its utilization occur because the assigned supply functions and responsibilities are not standardized among air stations. Additionally, the aviation supply experience of personnel of the same rate varies widely. Thus, at times SASI functions are utilized only to

TABLE 3-1

EXAMPLES OF AIR STATION ASSIGNMENTS FOR AVIATION MATERIEL RESPONSIBILITY

Air station	Materiel code				
	Type 1	Type 2	Type 3	Type 4	Type 5
Clearwater	Engineering	Supply	AMO	Avionics	Avionics
Corpus Christi	Engineering	Supply	Supply	Avionics	Supply
Mobile	AMO	AMO	AMO	Avionics	Avionics

the degree required by AR&SC and no more because locally generated materiel management processes are not supported in SASI.

- Often times, the organization that inputs data to, and extracts inventory reports and information from, SASI is physically separated and different from the organization responsible for inventory management and storage of the given aviation materiel. Under these circumstances, SASI capabilities are generally underutilized. Ad hoc nonstandardized software applications are locally generated and utilized in place of the standard SASI inventory applications. This difference is caused by the "unofficial" data processing (DP) rates who are developing skills to fill a gap in unit-level system capability. The "unofficial" DP rates are developing ad hoc SASI augmentation applications and using them in place of SASI when they are unable to integrate them with SASI use.

Conclusions

The specific organizational, policy, and personnel utilization differences among air stations are not directly important to SAIL development. However, as Figure 3-2 shows, these differences illustrate that SAIL applications are more likely to be used as intended if centralized supply management is implemented in a common manner at all units.

Unprogrammed functional requirements are inevitable, and some SAIL user/operator capability to develop local applications is beneficial; however, as Figure 3-2 shows, with this capability should come a reporting system that enables those applications to be nominated for approval by a SAIL Configuration Control Board (CCB).

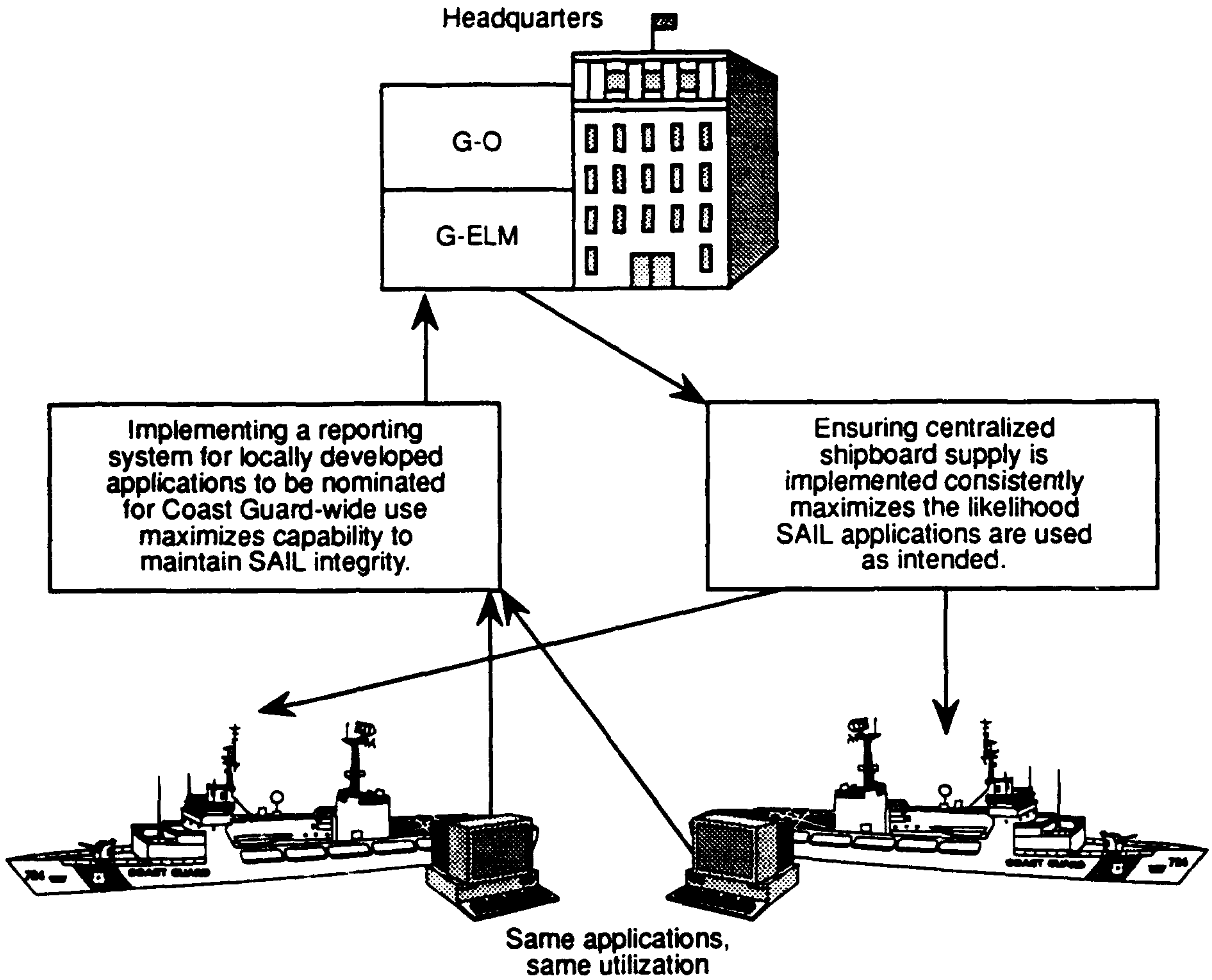

FIG. 3-2. CONDITIONS REQUIRED TO OPTIMIZE SAIL'S USE

Recommendations

We recommend that G-ELM's program for centralized shipboard supply ensure its implementation at all Fleet units in a common manner. Additionally, G-ELM should coordinate with G-O to consistently implement centralized shipboard supply prior to implementation of advanced SAIL applications.

We also recommend that G-ELM establish and implement policies to ensure the SAIL hardware and software environment facilitates user/operator ability to develop local applications and to develop a reporting system that utilizes a SAIL CCB concept for nominating locally developed applications for Coast Guard-wide use.

TIMING OF FUNCTIONAL TRAINING

Findings

The AR&SC has forecast that complex and sophisticated inventory management techniques will be introduced through AMMIS implementation. Inventory managers at AR&SC must be given in-depth functional training before they can utilize the projected AMMIS capabilities effectively. The inventory managers have typically been developed by promotion within the ranks, and few have received formal training in the more complex responsibilities of inventory management. Their training has typically been directed at fundamental item management provided through Navy courses at Norfolk, Va., and usually at the time of initial entry into the inventory management field.

The senior managers at AR&SC are fully aware of the training and experience shortfall. They clearly understand that the advanced inventory management practices are in the AMMIS functional requirements document and were included because of AR&SC's desire to improve inventory management. They also know they need a way to allow the inventory managers to apply the new capabilities available in AMMIS and have training requirements as a priority issue for resolution.

Conclusions

Figure 3-3 shows the need for functional expertise at all nonaviation organizations so that each can take full advantage of new capabilities provided by SAIL applications. Functional expertise is as important to successful use of SAIL applications as providing new capabilities through information systems hardware and software implementation. The functional operators at all levels are the only individuals who can realize SAIL capabilities, and they can only do so when they are adequately trained as part of the process of introducing new software capabilities. We reiterate our belief, originally stated in our report supplement, *Focusing Planning for Supply Management: Objectives, Policies, Oversight and Review*,

> . . . attendance at advanced training courses is an essential part of professional development for supply management personnel. Advanced training for . . . senior civilians should focus on the management philosophy of logistics. Fields of study should include . . . advanced inventory control management and distribution . . . .[4]

[4]LMI Report CG701R1 Supplement, op.cit.

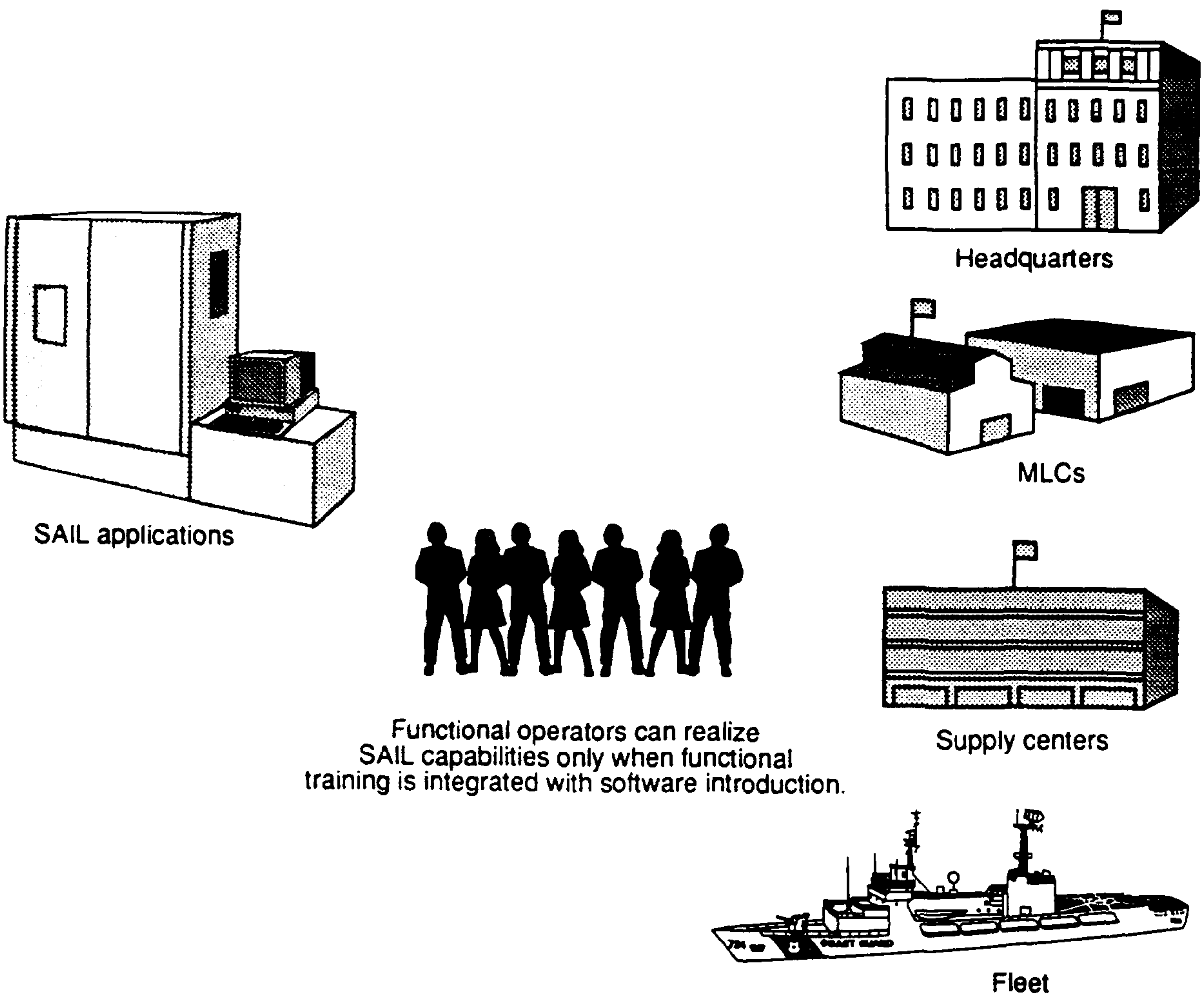

FIG. 3-3. FUNCTIONAL EXPERTISE IS REQUIRED TO TAKE FULL ADVANTAGE OF SAIL CAPABILITIES

Ensuring sufficient functional expertise exists to allow the Fleet, nonaviation supply centers, MLCs, and Headquarters to take full advantage of SAIL applications should be an integral piece of all SAIL implementation plans.

Recommendations

We recommend that G-ELM take the following actions to ensure all Coast Guard organizations have the necessary expertise to take full advantage of new SAIL capabilities:

- Implement joint planning with G-EAE and AR&SC to resolve any problems with AR&SC's inventory management training.
- Identify the lessons learned from solving AR&SC training problems and use them to establish the SAIL training plan.

- Incorporate in the SAIL training plan a requirement for nonaviation supply center inventory management supervisors to be placed on temporary duty at AR&SC where they can obtain an orientation and understanding of advanced inventory management techniques.

CONFIGURATION CONTROL BOARD ESTABLISHMENT

Findings

The AMMIS project was initially approved and funded for development on the basis of a functional requirements document that provided a high-level description of those functions AMMIS would support. Once those functions were approved for detailed development of system specifications, AR&SC had to decide what processes and procedures each operating division would use and what part of those processes and procedures would become system applications.

Development of detailed specifications was initially hampered by the absence of documented procedures at AR&SC. In addition, no single individual could explain how functional processes and procedures were performed within and among divisions. Each AR&SC division had its own perception of how functions should be performed. Faced with these conditions, AR&SC decided early to establish a CCB consisting of senior-level representatives from each AR&SC division.

The CCB was used early in the specification process to decide how functional processes and procedures should be performed and in which AR&SC activity they should reside. Subsequently, the CCB was tasked to conduct a detailed review of contractor deliverables to ensure that contractors had accurately documented the detailed functional specifications and had met the contract requirements. Future roles envisioned for the CCB include evaluating contractor-developed AMMIS applications as well as planning future AMMIS updates.

Conclusions and Recommendations

The CCB concept is applicable to SAIL development. SAIL needs a collective voice for functional specification and review of contractor deliverables. However, the multilayered nonaviation organization structure, combined with the wider scope of SAIL, requires the CCB concept be implemented differently than it is in the aviation community. We recommend that in addition to providing functional requirements,

reviewing draft specifications, and evaluating software applications, the CCB for SAIL should accomplish the following:

- Formalize the organization and structure of the SAIL working group.
- Provide consistent horizontal (MLC and supply center) and vertical (MLC/supply center to Headquarters or unit) integration of system design efforts.
- Establish a capability to horizontally and vertically integrate future process changes and system design efforts so that the effects are seen, evaluated, and agreed to prior to system application implementation.

We recommend that to achieve those SAIL CCB objectives, G-ELM develop and implement policies establishing multiple CCBs by taking the following actions:

- Establish policies requiring that a CCB be established for each system developed under the SAIL umbrella.
- Utilize the CCBs to provide the membership to the SAIL working group and SAIL Steering Committee.
- Assign CCB representatives the responsibilities of reporting to the Headquarters level (SAIL working group or Steering Committee) and back to their own CCBs.

SUMMARY

Table 3-2 lists those SAIL-related lessons learned discussed in this chapter and summarizes our recommendations for the nonaviation community.

TABLE 3-2

FLEET RECOMMENDATIONS

SAIL-related lessons learned	Recommendations
AMMIS hardware and software environment	SAIL should use decentralized processing with distributed capabilities. G-ELM should create and implement a detailed plan and schedule that ensures the Fleet can properly operate SAIL applications delivered. As G-ELM has previously espoused, such software training should be resident in the applications provided to the Fleet. G-ELM should coordinate with G-TIS to enhance COMDTINST 5230.40 so that a unit-level support capability to develop special reports and management innovations and to resolve standard workstation technical and configuration problems would exist.
Impact of air station organization on SASI utilization	G-ELM should establish a program for ensuring the Fleet implements centralized shipboard supply at all units in a common manner. G-ELM should coordinate with G-O to consistently implement centralized shipboard supply prior to implementation of advanced SAIL applications. G-ELM should establish and implement policies that facilitate user/operator capability to develop local applications and to develop a reporting system that utilizes a SAIL CCB concept for nominating locally developed applications for Coast Guard-wide use.
Timing of functional training	G-ELM should utilize AMMIS training experience and on-site training capability to assist Fleet logistics organizations in developing the necessary expertise to take full advantage of new SAIL capabilities.
CCB establishment	G-ELM should develop and implement multiple CCBs to review and integrate functional system requirements and approve software applications prior to delivery to units.

GLOSSARY

ACCB	=	Aircraft Configuration Control Board (USCG)
ACMS	=	Aviation Computerized Maintenance System
ADP	=	automatic data processing
AE	=	aviation electrician mate
AFC	=	allotment fund code
AMMIS	=	Aviation Maintenance Management Information System
AMO	=	Aviation Materiel Office
AR&SC	=	Aircraft Repair and Supply Center
AT	=	aviation electronics technician
C^3	=	command, control and communications
CASREP	=	casualty report
CCB	=	Configuration Control Board
CG298	=	air station unit allowance lists
COMDTINST	=	Commandant Instruction
CSMP	=	current ship's maintenance project
DP	=	data processing
ET	=	electronics technician
FLC	=	Fleet Logistics Center
G-E	=	Office of Engineering, Logistics and Development
G-EAE	=	Aeronautical Engineering Division
G-ELM	=	Logistics Management Division
G-ENE	=	Naval Engineering Division
G-M	=	Office of Marine Safety, Security and Environmental Protection

G-N	=	Office of Navigation Safety and Waterway Services
G-O	=	Office of Law Enforcement and Defense Operations
G-OAV	=	Aeronautical Operations Division
G-T	=	Office of Command, Control, and Communications
G-TES	=	Electronic Systems Division
G-TIS	=	Information Systems Division
HM&E	=	hull, mechanical, and electrical (systems)
ICP	=	inventory control point
ILO	=	integrated logistics overhaul
MK	=	machinery technician
MLC	=	Maintenance and Logistics Command
MLC LANT	=	Maintenance and Logistics Command Atlantic
MLC PAC	=	Maintenance and Logistics Command Pacific
MMC	=	Materiel Management Center
MMD	=	material management detachment
NMC	=	not mission capable
NMCS	=	not mission capable supply
NSN	=	national stock number
OGA	=	other Government agency
PC	=	personal computer
PDM	=	programmed depot maintenance
PMS	=	preventive maintenance system
SAIL	=	Systems to Automate and Integrate Logistics
SASI	=	Standardized Air Station Inventory (system)
SCCB	=	Supply Center Curtis Bay
SICP	=	ships inventory control point
SK	=	storekeeper

TCTO	=	time compliance technical order
WHEC	=	high-endurance cutter
WMEC	=	medium-endurance cutter